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VOL. I

FEBRUARY 1900

No. 5

The United States Industrial Publishing Company
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ELECTRIC VEHICLE CO. 100 Broadway, New York City

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AGENCY FOR FOREIGN SUBSCRIPTIONS:

INTERNATIONAL NEWS COMPANY

BREAMS BUILDINGS, CHANCERY LANE

STEPHAN STRASSE, NO. 18

LONDON, E. C.

LEIPSIK

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Entered at New York Post Office as second-class mail matter.

Price 25 Cents a Number; \$3.00 a Year

Foreign Subscription \$4.00, Post-paid

The Anatomical Museum

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Modern Mail Collection in America

The Automobile MAGAZINE

VOL. I

FEBRUARY 1900

No. 5

Automobile Postal Service

By Perry S. Heath

First Assistant Postmaster General

AS the main object of the Post-office Department is to provide for the safe and prompt transmission and delivery of mail matter, and as the officials who are entrusted with the administration of this important branch of the public service, as well as the legislators who provide for its maintenance, desire that it shall be conducted on strictly business principles, the different bureaus of the Department are constantly considering new inventions and devices which may prove of value, either by increasing the efficiency or diminishing the cost of the service.

The appearance on the streets of our cities of motor driven vehicles, and their employment by business establishments as delivery wagons, has suggested their use for the collection of mail from street letter boxes. The subject has been brought to the attention of the Department, not only by manufacturers and agents, who desire to further their own interests, but also by postmasters, who believe that this new departure in locomotion will aid them in solving one of the most difficult problems which the free delivery service in large cities presents—that is, the improvement of the collection service by providing for more frequent collections of mail from street letter boxes, and for more prompt and rapid transmission to post-offices and stations. This service is now performed by letter-carriers, and is costing the Government over four hundred thousand dollars (\$400,000) annually for horse hire and contract wagon service, in addition to the salaries of the carriers.

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Practical tests made in some of the larger free delivery cities have proved the adaptability of the automobiles for this work, but these tests were made in Buffalo, Washington, Detroit, and other cities where the streets are smooth, the boxes well placed, and all the conditions most favorable. The substitution of the automobile for the horse and wagon, and the introduction of a new collection system, would necessarily involve many radical changes in a service which is now thoroughly organized and giving general satisfaction, and the Department, while aiming to keep abreast of the most progressive business interests, would not be justified in making such changes until experience has proven the utility of the new style of vehicle under all existing conditions. Several manufacturers are now working on plans for automobiles, to be used exclusively in the postal service. Every facility will be afforded them for testing these vehicles when completed, and it is believed that it will not be long before the inventive genius which has given us the horseless carriage will have overcome all difficulties. The Post-office Department will then be able to supply vehicles built to travel over all kinds of roads, in all kinds of weather, and vastly superior, as regards safety and speed, to the



Dr. Martin, of Buffalo, and his "Pioneer."
The First Test of Automobile Mail Collection in America.

Automobile Postal Service.



Postal Automobile in Berlin.

wagons and carts drawn by horses, now used in the free delivery service.

The employment of the automobile in the collection and distribution of mail matter was one of the first uses which suggested itself, when the possibilities of the motor vehicle for public service began to be considered. Certainly in no other single field does it hold out greater probabilities of benefit to the whole people. Traveling at a considerably greater speed than the street cars, and enabled to reach points by far more direct routes and without numerous delays, the advantages which the vehicles possess for city postal service are readily apparent. On the other hand, with rural free delivery likely to ere long become an established fact in all the more densely populated sections of the country it may be seen also that by the utilization of the new motive facilities the residents of our farms will in many cases be enabled to enjoy almost as many opportunities for quick communication as their city cousins.

The use of the automobile for postal service in Germany and France has long since passed the experimental stage. The post-office authorities of Berlin some time ago put into practical use six of the Loutzki automobiles, and so successful was the experiment that a large additional number of the vehicles were soon after ordered from the manufacturers. The experiment in Berlin so completely demonstrated the efficiency of the motor vehicle for the work that a number of the other large cities in Germany

The Automobile Magazine

immediately began preparations to introduce the system. The French government is not only regularly making use of automobiles for the transportation of the mails in Paris and other large cities, but has recently ordered fifty heavy wagons, each equipped with nine horse-power gasoline engines, for the purpose of carrying mail in the Soudan.

The initial introduction of the automobile in postal service in this country was made some months ago in Buffalo, N. Y. The vehicle used was an electric phaeton of about one ton weight, manufactured by the Pope Manufacturing Company. As a speed trial a four mile run from the main office to a sub-station was made in nineteen minutes, and the return trip consumed but eighteen minutes. During the collection trial the route covered was the same and mail was collected from twenty-two regulation boxes and eight package boxes—a total of 150 pounds—in thirty-three minutes.

This practical test of the adaptability of the automobile for the work of collecting mail from street letter boxes was made at Buffalo, under the auspices of the department, and the result, so far as related to that city and its superb streets, was entirely satisfactory. The experiment leads to the conclusion that valuable improvements for the collection branch of this service are in store through this departure in locomotion, limited at present by requisite conditions, which seems to demand asphalt or other smooth pavements.

The first automobile to be manufactured especially for mail collection service was one constructed by the Winton Motor Vehicle Company, of Cleveland, and is herewith illustrated. The test of this vehicle recently made in Cleveland was entirely successful, and was all the more remarkable from the fact that it took place during a fierce snow storm and under about the most unfavorable conditions imaginable. The test was made over a twenty-two mile route, and mail was collected from 120 boxes. Under ordinary conditions a collector with horse and



French Letter Carrier.

Automobile Postal Service



Collecting Mail in Cleveland

wagon can cover this route in exactly six hours, but even under the unfavorable conditions noted the automobile performed the work in two hours and twenty-seven minutes.

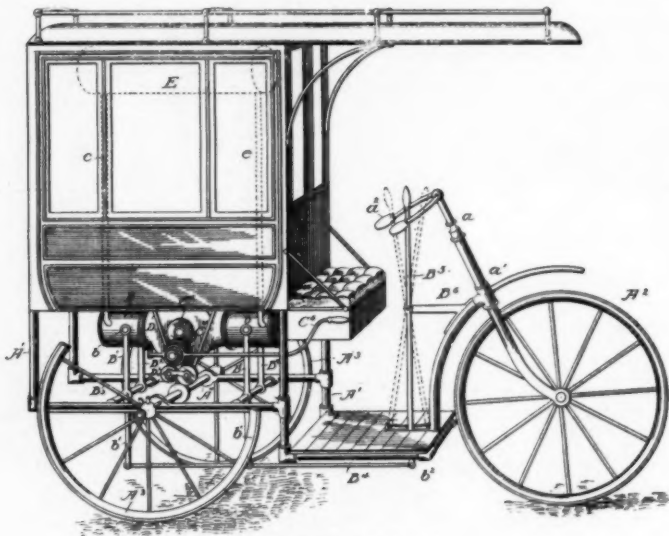
In speaking of the test Postmaster Dewston, of Cleveland, said: "The test was a very severe one, on account of the snow-storm, but the result was most satisfactory. Comparing the time taken in covering the route with the time required by horse and wagon the test speaks highly in favor of the use of automobiles in the collection of mail. It takes ten horses and wagons to collect the mail in Cleveland now, and the test shows that the work could be done with five automobiles. The post-office department is much interested in the automobile, and I think that it is only a question of time when it will be adopted."

In a recent letter to Waldon Fawcett, of Cleveland, Postmaster Dickerson of Detroit, who is one of the most progressive officials in the service in the country, says: "About sixty days ago a three-wheeled affair appeared in front of our office, and out of curiosity we tested it. We have one carrier's route that takes two hours and thirteen minutes to cover. We put the carrier on this three-wheeled vehicle, and all the boxes within that route were picked, the entire route covered and all mail collected in one hour and eight minutes, and to my mind this article came the nearest to what postmasters want for collection of mail from boxes of anything I have yet seen."

The Automobile Magazine

A similar vehicle for postal purposes is R. H. Plass' automobile, the designs for which have been favorably considered by Postmaster Wilson of Brooklyn, who was authorized to test postal automobiles.

In the drawing, A represents the body of the vehicle. Attached to the frame A' of the vehicle are the three supporting-wheels A^2 and A^3 A^3 . The front wheel A^2 is suitably mounted on a standard a , mounted in a suitable socket a' , provided at its upper end with handles a^2 for turning the wheel to guide the vehicle. The supporting-wheels A^3 are permanently attached to



The Plass Postal Vehicle

a shaft A^4 , mounted in the frame A' of the vehicle and provided at its center with a friction-wheel A^5 , which is designed to receive through suitable intermediate mechanism motion from an engine B .

The engine B is mounted on upright rods $B^1 B^2 B^3$, which are respectively pivoted on horizontal rods B^4 , attached to the frame A' of the vehicle.

The engine may be of any suitable construction, preferably for naphtha or gasoline.

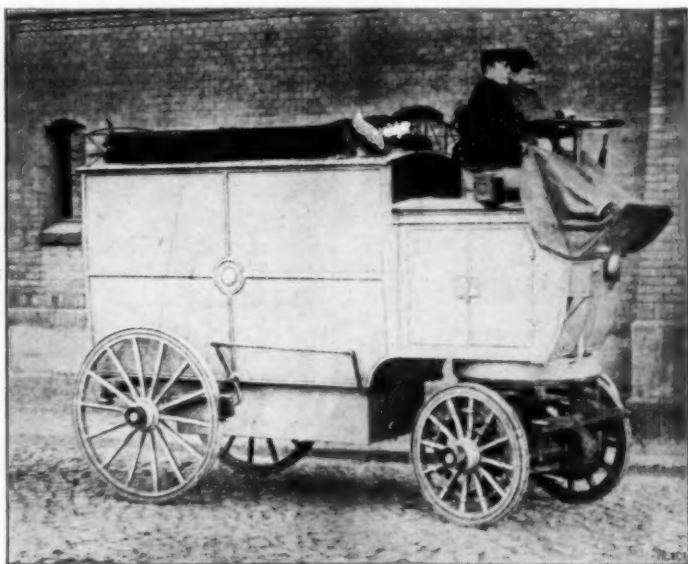
Another vehicle which was thoroughly tested by Postmaster Wilson of Brooklyn was the Locomobile runabout pictured in

Automobile Postal Service

our frontispiece. After subjecting this vehicle to a series of searching tests, Postmaster Wilson declared himself amply satisfied with its practical qualities.

While still engaged in these tests Postmaster Wilson expressed himself as follows:

"The more I go into this matter the more convinced I become that the use of automobiles is practicable. We now pay 12 cents per mile for all mail carried. Our service in Brooklyn costs about \$60 a day. I understand that the automobiles can be operated



German Accumulator Mail Wagon

at about three-quarters of a cent per mile. Thus you can figure out the saving. Here is a man who says we can buy gasoline for \$1 a barrel of fifty gallons. He guarantees one horse-power for ten hours for each gallon. But figuring it out at the highest figures yet received, I can see a clear gain of about \$25 a day, from which the interest on the investment can be paid and furnish a fund for repairs and leave a large surplus. It now costs the Brooklyn office \$72,000 a year to handle the mails. We pay \$16,000 a year for the electric cars, \$4,000 for the carrying of the closed pouches on the ordinary cars, \$10,000 for car tickets,

The Automobile Magazine

\$28,000 for the wagon collections and \$14,000 for the railway mail service. As I figure it out we can make a saving of fully 25 per cent. of this amount and also establish our own plant. We would require about eight wagons for station work, six heavier wagons for the railway service and about thirty light wagons for the collections. These wagons in the hands of our own men, who can soon become competent in the service, will add probably 25 per cent. to the efficiency of the service and make the office independent of accidents.

"The railroad people have had a good thing out of this service, even aside from the money they receive, for they have the assurance in times of strife of having their lines kept open by the United States mails. Why, I have heard railroad people say that it would be a good thing to have the mails go over their roads without charge to have the assurance that their lines would not be interfered with. I believe that Brooklyn will be the first office to adopt this system. In any event, the whole question will be inquired into very carefully."

The postmaster of Boston said: "I believe that the automobile would be of great benefit and could be utilized to much advantage in the mounted carrier service." Postmaster Samuel



Oakman Mail Cart

Automobile Postal Service



Vollmer's Postal Wagon

G. Dorr, of Buffalo, states that he expects ere long to have automobiles in constant use for mail collection in that city.

Already, in Buffalo, mail is being carried in an electric trap from the post-office to Station D, a distance of four miles, in eighteen minutes. Thirty mail boxes in that distance are tapped, and the trip is made in thirty-three minutes. In this trip 150 pounds of mail are collected.

At Baltimore a test was made with a steam carriage, the inventor of which achieved a speed of thirty miles an hour. In Washington the electric wagon was used, and tests were made with various other motors.

In Chicago several tests have been made in the collection districts, and the showing was so creditable that the Second Assistant Postmaster-General has called for bids for a permanent automobile service for the conveyance of mails and supplies between the general post-office and certain downtown stations. No contracts, however, have as yet been awarded.

An objection was originally raised to the employment of automobiles for postal service between main offices and sub-stations which was based on the claim that the employment of the automobile would make it difficult, if not impossible, to sort mail *en route*. Automobile manufacturers have, however, demonstrated to the satisfaction of post-office officials that they can construct auto cars in which this work can be done quite as easily and expeditiously as on the mail cars now in service on the street railways in many of the larger cities.

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Mention has been made above of the automobile postal cars employed by the French government in the Soudan. These cars, let it be understood, are post coaches intended for passenger service rather than mail delivery wagons.

The British Colonial government, on the other hand, has taken steps to introduce automobile mail wagons in the true sense in some of the most distant crown colonies.

The steam wagon shown in the illustration below is one built by the Lancashire Steam Motor Co. of Leyland, England, for use by the British government in the postal service in Ceylon. It is constructed to carry one ton of mail matter and will average ten miles an hour on fair roads. This autocar was put through a long and severe series of tests by the British postal authorities before it was allowed to be despatched to its destination.

Thus it may be seen that the rule of the white man over other less developed races does indeed confer upon them some of the latest and most admirable products of civilization.



Civilization in Ceylon



Race Track of Vienna

Motor Racing

By Edwin Emerson, Jr.

IF horse racing is indeed the Sport of Kings, then motor races must be the sport of millionaires. Surely it takes millionaires to furnish sweepstakes reaching the hundred thousand mark, as have been demanded of late for some of the more momentous motor races, not to mention the racing carriages themselves which have been known to fetch as much as 60,000 francs for one single vehicle.

Now that an international challenge cup for automobile races has been established by an American gentleman, not unmindful, it is fair to presume, of the fate of that other international trophy—the America's cup—this country has entered into the spirit of these races with a zest which promises the best of sport for all concerned.

On this side of the Atlantic ocean the sport of motor racing is still in its infancy. Altogether not more than a score of such contests have been waged.

Leaving out of account several unofficial brushes between the lucky owners of some of the earliest automobiles that were seen in America, the first contest that can truly be called a race was that held under the auspices of the *Times-Herald*, in Chicago, on November 28, 1895. This was followed in 1896 by the *Cosmopolitan Magazine* race up the Hudson river, from New York to Irvington. Both of these races were won by the Duryea type

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Jenatzy's Racing Projectile

of gasoline-propelled carriages. After this the vast multiplication of types gave rise to new rivalries, and the motor bicycle and tricycle for track racing and pacing purposes appeared. For these machines, too, the season's sport opened as usual in France. First the Perigord challenge road race was run from Paris to Rouen and back, a total distance of $132\frac{1}{2}$ miles. Girardot, one of the four starters, was the first to reach the turning point, which he did in 2h. 18m., finishing in the lead in 4h. 26m. for the entire distance, an average of nearly thirty miles per hour, not allowing for twenty minutes' necessary stops. The winner's machine was a Panhard-Levassor petroleum vehicle, weighing 1,600 pounds, driven by an eight horse-power four-cylinder motor. The same machine finished well up in the list in the Paris-Amsterdam road race.

The sport in the United States did not begin until late summer. As has been told in Mr. Reeves' excellent article on Motorcycle Racing which appeared in our last issue, a five-cornered contest for 25 miles between teams of motor cycle riders was held at Manhattan Beach cycle track on September 4, the competing teams being Fournier and D'Outrelon, Waller and Steenson, Stinson and Stafford, Ragan and Caldwell, and Judge and Miller. This last pair were mounted upon a Jaillu machine, fitted with a De Dion motor, the rest upon American Orient machines. Miller and Judge finished first in 39.58, Stinson and Stafford second in $41.17\frac{2}{5}$, and Caldwell and Ragan third in

Motor Racing

42.30 $\frac{3}{5}$. The following are the times made in this contest, being American records for motor cycles from two miles to the finish:

Miles.	Time.	Miles.	Time.
1.....	1.36 $\frac{2}{5}$	13.....	20.21 $\frac{1}{5}$
2.....	3.07 $\frac{3}{5}$	14.....	22.00 $\frac{3}{5}$
3.....	4.40 $\frac{1}{5}$	15.....	23.37
4.....	5.14 $\frac{4}{5}$	16.....	25.13 $\frac{4}{5}$
5.....	7.45 $\frac{4}{5}$	17.....	26.52 $\frac{2}{5}$
6.....	9.19 $\frac{3}{5}$	18.....	28.28 $\frac{3}{5}$
7.....	10.53	19.....	30.06 $\frac{2}{5}$
8.....	12.27	20.....	31.43 $\frac{1}{5}$
9.....	13.59 $\frac{4}{5}$	21.....	33.20 $\frac{1}{5}$
10.....	15.33 $\frac{4}{5}$	22.....	34.56 $\frac{4}{5}$
11.....	17.06	23.....	36.36
12.....	18.43	24.....	38.17 $\frac{3}{5}$
25.....	39.58		

During this same time but few genuine automobile races were held in this country. The attempt to hold an international long distance race over American roads fizzled out before the project had got well under way, and another attempt at a long distance record across the American Continent resulted in ignominious



Baron Turckheim in His Dietrich Racer

The Automobile Magazine

failure. The event that came nearest to a *bona fide* contest was last year's race for a \$2,000 sweepstake at Galesburg, Ill.,* between E. B. Snow, of Wyoming, and Dr. Morris, of Galesburg. Though the challenge had been for fifty miles only fifteen miles in all were made by the winner, owing to the breakdown of the challenger at this point. The fifteen miles were done in forty-three minutes and fifty-four seconds.

The popular idea upon which the speed of an automobile depends is, like most popular ideas, entirely wrong. By some it is held that a certain automobile is faster than another merely because its motor develops a greater number of horse-powers. Others maintain that the speed of the carriage is governed by the size of the wheels, and support their statement by comparing the automobile with the high-speed locomotive, which, with its huge drivers, is speedier than the small-wheeled freight engine. Undoubtedly there is a grain of truth in the assertion that a relationship exists between speed and horse-power; but if the subject be critically studied it will be found that the factor of speed in motor-carriages depends not upon one condition alone, but upon five—(1) the horse-power of the motor; (2) the number of revolutions made by that motor; (3) the weight of the vehicle; (4) the gearing; (5) construction of the moving parts as well



Dr. Lehwess in His Racing Vallee

* See article "An American Auto Race" in the November issue of this Magazine.

Motor Racing



M. Mors in His Own Racer

as of the entire carriage, to reduce friction as much as possible.

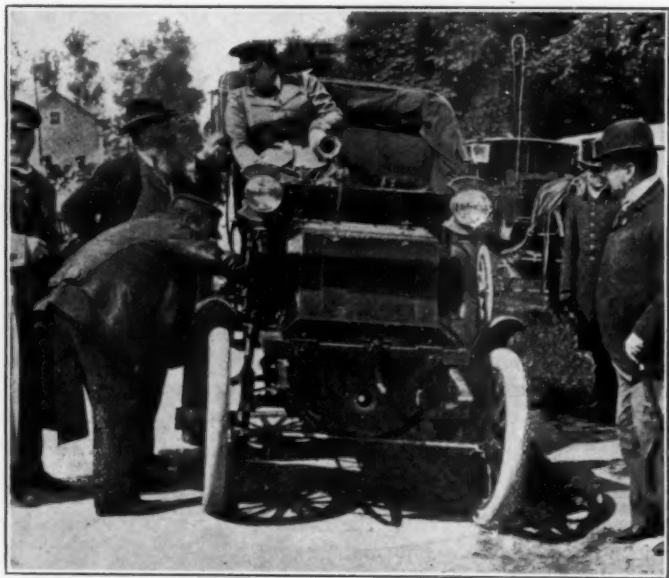
If the other four conditions be the same, it cannot be denied that, of two carriages, the faster will be the one having the more powerful motor.

But the speed of a motor has also an effect upon the speed of the carriage; for the greater the number of revolutions made per minute by the fly-wheel, the more swiftly will the driving-wheels of the carriage be turned by the intermediate gearing, and the greater will be the distance covered in a given time. The number of revolutions made by automobile motors varies between 600 and 1,200 per minute; the average motor makes between 800 and 900 revolutions. In all modern automobiles the number of revolutions can be increased by means of an "accelerator." If the motor were constantly run at maximum speed it would very evidently soon deteriorate, for which reason the careful automobilist will push his carriage to the utmost only when he is ascending exceedingly steep grades or when it is necessary for him to cover a given distance in the shortest possible time. As a general rule, high-speed motors are used only on pleasure vehicles; heavy trucks, in which tractive force is the main consid-

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eration, are usually driven by engines which make comparatively few revolutions per minute.

Weight is also an important condition upon which the speed of the carriage depends. Often enough it has happened that in ascending a grade one of the occupants of a vehicle has been compelled to alight in order that the motor, already running at its highest speed, might drive the carriage to the summit. Indeed, the motor is sometimes capable of driving only the vehicle up a hill, and the driver himself must perforce walk beside his



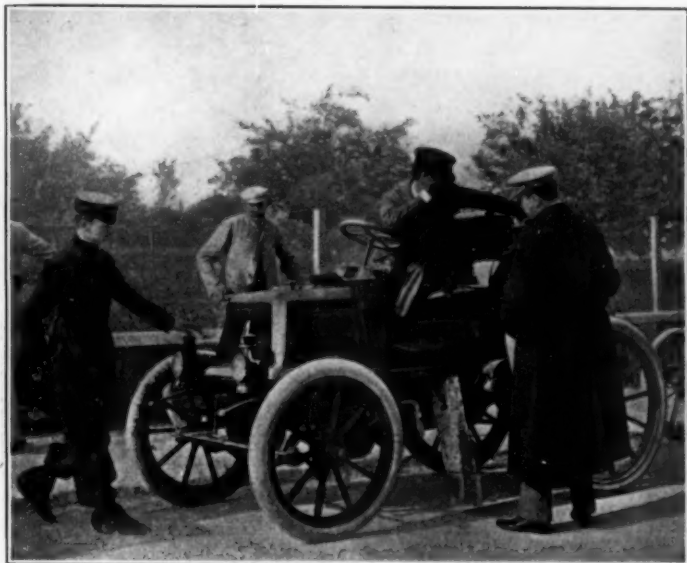
Baroness Zuylen de Nyevelt Getting Ready to Start

carriage. It is plain enough that a 12 horse-power carriage weighing only 1,500 pounds will make better time than if it weighed 2,500 pounds, and that a light, two-seated cart will be speedier than a heavier, four-seated vehicle. As an example, heavy autotrucks may be cited, which, although provided with powerful motors, run at very low speeds but develop considerable tractive force. These trucks can transport loads varying from 5 to 10 tons, depending upon the horse-power of the motor. For this reason, French manufacturers are beginning to build wagon bodies of partinium, an aluminium-tungsten alloy of very nearly

Motor Racing

the same specific gravity as pure aluminium, but of far greater strength.

The speed of automobile vehicles, whether racing machines or otherwise, has been steadily increasing. This is due largely to the public contests that have been held for the last few years in France and other places on the continent. Indeed it can be truly said that the present flourishing condition of the automobile industry in France has been largely brought about by the generally favorable attitude of the French press, aided by the energetic enthusiasm of special publications, such as "Le Vélo," "La



Count Bozon de Perigord Waiting for Starting Signal

France Automobile," "La Locomotion Automobile," and "Le Chauffeur."

Almost all the men that have figured in these events will once more come to the front during the great races that are to be run off during the time of the Paris Exposition.

This list has been recently published, and embodies many interesting features. The first event of the season will be decided on Sunday, April 15, and will be the fifth annual race from Paris to Roubaix, in which a category for motor cycles will be reserved. The distance to be covered is 288 kilometres; the entry fee is 5

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francs, and the entries will be received up to mid-day, April 9. Prizes of 500, 250, 150, 100, and 50 francs are offered.

On Thursday, April 26, a competition for electrically-propelled vehicles will take place over a course from Paris to Dijon. Entries, accompanied by a fee of 100 francs, will be received up to mid-day, April 23. This competition is distinctly original, as all the vehicles entered, whether light or heavy, big or little, will compete on the same footing. Despatched from Paris they will be required to travel along the route to Dijon until they can proceed no further. The automobile which last ceases to move, provided it has averaged sixteen kilometres per hour, will be



Heavy Weight Race at Nice

declared the winner. Thus, this competition is really a test of capacity, and although many objections as to the entire fairness of the scheme will doubtless be raised, still the idea is too good to be dropped, and it is to be hoped that the promoters will receive sufficient support to enable the event to be decided.

The next automobile event will be held on Thursday, May 3, and will consist of the fourth annual motor-cycle competition between Etampes and Chartres. The distance is one hundred kilometres, the entry fee 20 francs, and engagements will be received up to Tuesday, May 1, at mid-day. Prizes ranging from 200 francs to 1,000 francs are offered.

Motor Racing

This will be followed by an event over the same course reserved for voiturettes weighing not more than 400 kilos. Thursday, May 10, is the date fixed, and entries will close on the previous Tuesday, the fee being 20 francs, and the prizes of the same value as those for the motor-cycles.

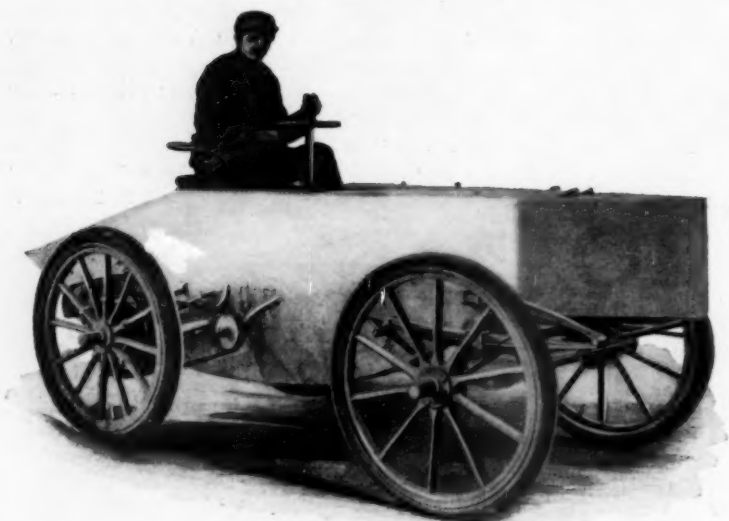
Again, on Thursday, May 17, the motor-bicycles will be afforded an opportunity to display their prowess over the same route. This event will only be open to motor-bicycles not exceed-



René de Knyff, the "King of Chauffeurs"

ing 40 kilos. in weight. Entries will close May 15, at mid-day; fee, 20 francs. Wednesday, May 23, will witness the Derby for automobiles. Paris to Bordeaux in a single stage of 568 kilometres is no light undertaking even for a French racing automobilist, but each year witnesses increased entries for the historic race. The categories will be: Cars, entrance fee, 200 francs; small cars (less than 400 kilos.), 150 francs; motor cycles, 100 francs. Names of intending competitors will be received up to May 19. The final competition, which *Le Vélo* will promote next year, will be another race up the hill of Gaillon, and this

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Count Chasseloup-Loubat

will be decided on 11th November. The categories will be— (1) cars weighing more than 400 kilos.; (2) cars weighing from 250 to 400 kilos.; (3) cars weighing less than 250 kilos.; (4) motor cycles weighing less than 150 kilos.; (5) motor cycles of two seats (occupied); (6) bicycles; (7) chainless. The entry fee is 10 francs, and names will be received up to the previous day at 12 o'clock.

A unique contest will be the amateur road race devised by M. Albert Lemaitre, which is to be held under the auspices of "La France Automobile" on June 8, in the week after Witsunday. The distance will be from Paris to Rheims, and the prizes are to consist solely of baskets of champagne.

The competitors must be members of the Automobile Club de France, and must not be accompanied by a professional or amateur automobile driver or mechanic.

Further, each competitor must have a lady by his side, the idea apparently being that under these conditions he will not take racing risks.

Another unique contest is that which is to be held on a wager of the Baron de Caters and Jenatzy, the well-known builder of the projectalite racing machine which we illustrate in these pages. These gentlemen have laid a wager that they would build and

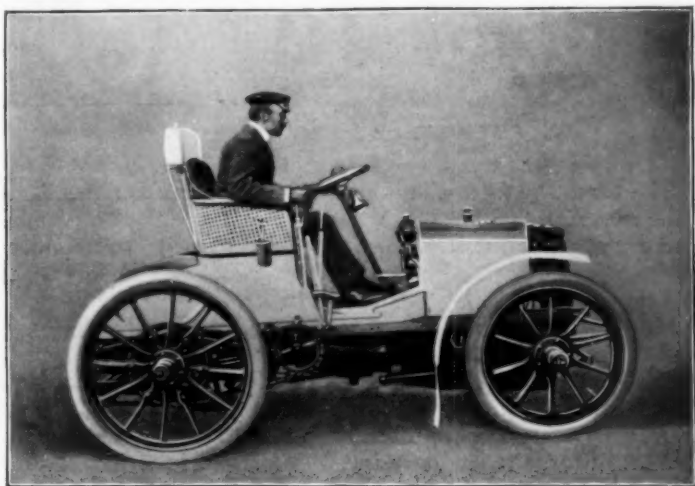
Motor Racing

drive an electric automobile capable of covering one hundred kilometres within an hour. If their bet is accepted the race will be run over that remarkably level stretch of road of nearly 100 kilometres, from Evereux to Lisieux, which has but one hill during its whole stretch, and that only a slight grade between Rivière and Thibonville.

The most important contest of all, needless to state, will be the great international series of races for the challenge cup given by Mr. James Gordon Bennett, of America. This contest will be held on Thursday, June 14, la Fête-Dieu of the French. Altogether five clubs, through their selected teams, will compete for this coveted trophy. They are the automobile clubs of France, Belgium, Germany, Italy, and America.

In France the first result of the offer of the international cup was that everybody aspired to the glory of defending the trophy. There was certainly good material to chose from. In the first line there are MM. René de Knyff, Charron, Girardot, Chasseloup-Loubat, Gilles Hourgières, Albert Lemaitre, and Levegh. These gentlemen are all veritable kings of the road, as a glance at a very few of their achievements will prove.

M. de Knyff has figured prominently in all of the many races in which he has competed, and his two principal victories have been those scored in the Paris-Bordeaux race, 1898, and Le Tour de France, 1899.



Charron in his Winning Panhard

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M. Charron has had a wonderfully successful career, and among many performances his wins in the Marseilles-Nice, 1898, Paris-Amsterdam, 1898, and Paris-Bordeaux, 1899, are all particularly noteworthy. M. Girardot has always been one of the most consistent drivers in the racing world, and enjoys the distinction of having been second in big races more frequently than any other *chauffeur*. A sort of fatality seemed to follow his steps, and "seconds" in Paris-Amsterdam, 1898, Nice-Castellane, 1899, and Le Tour de France, 1899, may be instanced as his near approaches to victory. More recently he has succeeded in passing the winning-post first, as witness Paris-Ostend and Paris-Boulogne. In the former he "dead-heated" with M. Levegh.



Start of Paris-Amsterdam Race

The Count of Chasseloup-Loubat will always be remembered as the adversary of M. Jenatzy in the series of electromobile speed tests which took place in the early spring of this year. Previous to this he had won the Marseilles-Nice race in 1897, and this summer he took third prize in Le Tour de France.

M. Gilles Hourgières has experienced a lengthy career, as in 1897 he won both the Paris-Dieppe and the Paris-Trouville races. In 1898 he finished second in the Marseilles-Nice event, and gave a phenomenal performance in the Paris-Amsterdam *course*, after experiencing a breakdown in the early stages of the race. This year he has only raced once, viz., in the Paris-Bordeaux, when he was placed fifth.

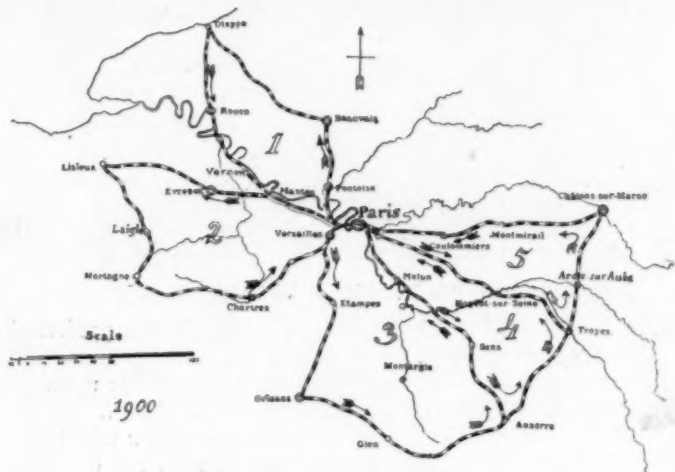
M. Albert Lemaitre has scored victories in Marseilles-Nice,

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1897, and in Nice-Castellane, the Nice mile race, and the de la Turbie and Pau-Bayonne races, 1899.

M. Levegh gained two brilliant victories this year in the Paris-Ostend and the Bordeaux-Biarritz events, his average time in the latter race being altogether exceptional.

In 1898, the famous French racer, "Rigal," covered a kilometre in $1.20\frac{2}{5}$ over a level stretch. Villemain covered the same distance in $1.16\frac{1}{5}$ on an inclined plain, averaging eight per cent. Different machines figured in these two tests. Even in the case of machines of identical construction, however, a corresponding



Map of French Five Day Race for 1900

1st day—Paris, Pontoise, Beauvais, Dieppe, Rouen, Vernon, Mantes, Paris.

2d day—Paris, Mantes, Evreux, Lisieux, Laigle, Mortagne, Chartres, Rambouillet, Paris.

3d day—Paris, Versailles, Etampes, Orléans, Gien, Auxerre, Sens, Montereau, Melun, Paris.

4th day—Paris, Melun, Montereau, Sens, Auxerre, Troyes, Nogent-sur-Seine, Paris.

5th day—Paris, Nogent-sur-Seine, Troyes, Arcis-sur-Aube, Châlon-sur-Marne, Montmirail, Coulommiers, Paris.

increase of speed had been noted. In 1898 Marot covered one kilometre in $1.42\frac{2}{5}$ over a level stretch. At the end of last year Bardin took a motor of the same makers over a kilometre, with an inclined plain of eight per cent., at the rate of $1.36\frac{4}{5}$.

The obvious course for the French Club would have been to avoid complications by leaving the selection of the races to merit and chance—after the manner of our trial yacht races—that is, by holding trial races and making those *chauffeurs* who would come out as first, second and third winners the defenders of the French Club. Instead of adopting this simple plan, the Com-

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De Paiva in his Dietrich

mission Sportive of the Automobile Club de France preferred to be guided by its own judgment, and accordingly rendered an off-hand decision, which threw the burden of defence upon those lucky *chauffeurs* MM. Knyff, Charron and Girardot.

This decision so offended some of the *chauffeurs* who thought that they should have had an equal chance with the others that they are reported to have gone over to the enemies of France. Thus MM. Lemaitre and Velghe, who race under the *noms de guerre* of Anthony and Le Veghe, have officially informed Baron Zuylen, the President of the French Club, of their intention to fight for the cup under Belgian colors. Another member of the French Club is understood to have been won over by the German Automobile Club and will probably enter the race with a machine made by a French firm in Alsace. The alleged turncoat is M. Loysel, the winner of the first race from Bordeaux to Biarritz, and likewise the first to establish a record for the kilometre during the trials in the Park of Achères.

The American challengers for the cup are Messrs. Alexander Winton and Andrew L. Riker. Mr. Winton will race in a machine similar to that in which he made the run from Cleveland to New York last year. Mr. Riker will enter with a new machine specially devised for this race. The third challenger is believed to be the Locomobile Company of America.

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Unlike our American contestants the French challengers were selected from a field of nearly half a hundred candidates. Their official averages, as computed by *Le Vélo*, are as follows:

Girardot	3	4	2	0	1	38
R. de Knyff	3	4	1	0	0	34
Levegh	3	3	0	0	2	29
Lenaitre	4	0	1	0	0	23
Charron	3	0	1	1	0	20
Antony	2	1	0	0	0	14
Chasseloup-Laubat	1	1	0	1	1	12
Pinson	0	0	2	2	2	12
Giraud	0	2	0	1	0	10
Koechlin	0	0	2	1	0	8
Heath	0	0	1	2	0	7
Loysel	0	0	0	3	0	6
Broc	0	0	1	0	1	4
Jamin	0	0	1	0	0	3
Petit	0	0	1	0	0	3
Henon	0	0	1	0	0	3
De Dietrich	0	0	1	0	0	3
Archambaud	0	0	0	1	0	2
De Castelnau	0	0	0	1	0	2
Huillier	0	0	0	0	1	1
Jenatzy	0	0	0	0	1	1
Flash	0	0	0	0	1	1



Alexander Winton in his Racer

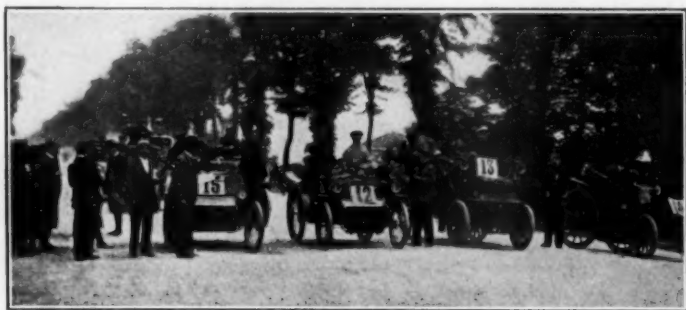
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Locomobile Winning the Nice-Monte Carlo Race

The situation now appears thus: If the cup is won by M. Knyff, he will be a Belgian racing for the French Club; if by M. Lemaitre, by a Frenchman in behalf of Belgium; if by M. Loysel, by a Frenchman racing under German colors. Should we carry off the cup, on the other hand, Mr. Bennett's donation may be regarded as something of a "Greek gift."

No wonder the editor of *Le Vélo* calls the trophy a "cup of discord." But the more trouble, the merrier, for all these international complications will only serve to increase the gayety of the nations as they assemble at the new World's Fair on the Seine.



The End

The French Racing Rules

PREAMBLE.

THE ideas which have governed the drawing up of the present Racing Rules are the following:

1. The Automobile Club of France is the sole authority regulating races of automobile vehicles and motor cycles.

2. The general spirit of these rules is that the races are run and won by a combination of the machine and its riders, which must not be separated during the race.

I.—GENERAL RULES.

Article 1.—Every competitor entering for a race of motor vehicles or motor cycles is supposed to be acquainted with these rules, and undertakes to abide, without dispute, by the results to which such rules may lead.

GENERAL PROVISIONS.

Art. 2.—All automobile races and record trials organized in France shall be controlled by the Racing Rules of the Automobile Club de France.

Art. 3.—All races which are not controlled by these rules are forbidden, and all competitors therein will be disqualified.

PUBLICATION OF PROGRAMME.

Art. 4.—The programmes of races—

(1) Must be sent to the Sporting Committee of the Automobile Club de France; (2) and must be published in the Press at least five days before the races, if they be on the track, or fifteen days if they be on the road.

Art. 5.—The programme shall contain—

(1) The number of the prizes and the amounts for each race; (2) the distances; (3) the amount, if any, of entrance fee attached to each event; (4) the date and hour for closing of entries; (5) the amount of forfeit, if there be any; (6) the place at which entries are received; (7) complete and exact itinerary of road races. These itineraries shall not undergo any modifications, except from absolute necessity, in such cases notice shall be immediately given individually to each competitor.

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Art. 6.—After publication of the programme no modification shall be made in it as regards prizes—the amount of which shall not be increased—or as regards the nature of the races originally announced. Mention shall be made on the first page of all race programmes that the meeting is held under the rules of the Automobile Club de France.

Art. 7.—A copy of the programme and rules shall be sent to each competitor on his entering for a road race.

CLASSIFICATION OF RACES.

Art. 8.—Races shall be “open” or “reserved.” “Reserved” races shall be races confined to competitors fulfilling a definition stipulated by the promoters.

CATEGORIES.

Art. 9.—The categories officially recognized by the Automobile Club de France are as follows—

- (1) Vehicles (motor cycles and small carriages) weighing under 250 kilogs. (5 cwt.); (2) vehicles weighing more than 250 kilogs. and carrying at least two passengers side by side of an average of not less than 70 kilogs. (11 stone) each, it being understood that if the average weight of the passengers does not amount to 70 kilogs. (11 stone) each, the deficiency may be made up with ballast. In track races and records, however, vehicles with two seats need only carry one passenger, but in road races two passengers are compulsory.

In addition, the promoters may subdivide the two foregoing categories into as many classes as they please.

Art. 10.—The Sporting Committee shall be the sole judge of the classification of all motor vehicles, as well as of questions which may arise therefrom.

ENTRANCE FEE AND FORFEITS.

Art. 11.—The amount of the entrance fee shall be fixed by the promoters, who will decide whether it is repayable or not to the competitors who have started.

Art. 12.—The forfeit is not a matter of right; it must be specified on the programme, as also its amount.

Art. 13.—Entrance fees which are repayable and forfeits, if they are not claimed within a month, shall become the property of the promoters.

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ENTRIES.

Art. 14.—Entries shall be made as follows—

(1) By letter; (2) by telegram, confirmed by letter of same date.

Art. 15.—Any entry which is not accompanied by the fee or which is sent in too late will be annulled *ipso facto*.

Art. 16.—Any competitor wilfully sending in a false statement may be prevented from starting, and will be liable to a fine.

RACING NAMES.

Art. 17.—Any competitor may use a racing name subject to approval by the Sporting Committee.

Art. 18.—The racing name becomes permanent and cannot be changed without the permission of the Sporting Committee, to whom a written request must be sent, accompanied by a fee of 20 francs.

STEWARDS OF THE COURSE.

Art. 19.—In every race upon the road or on the track the promoters shall choose three stewards, whose appointment must be approved of by the Sporting Committee, and whose names should be communicated at the same time as the programme.

Art. 20.—The stewards are entrusted with the carrying out of the programme, and with seeing that the rules are strictly observed, and are also to settle any protest that may arise out of the race.

Art. 21.—The stewards can either prevent a competitor from starting, or start him after the others, if his inexperience or the construction of his car would seem to present a danger to other competitors.

Art. 22.—The stewards have a right—

(1) To prevent a competitor from starting; (2) to publicly reprimand a competitor; (3) to impose fines up to a maximum of 200 francs (£8); (4) to disqualify a competitor for a maximum period of a month.

In these two latter cases the competitor has a right to appeal to the Sporting Committee.

Art. 23.—Should the stewards deem that a heavier fine ought to be imposed, they can apply to the Sporting Committee, which has full power to inflict any penalty after taking evidence from those interested.

Art. 24.—The starter is appointed by the stewards, and he alone judges the validity of a start.

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Art. 25.—As a general rule the start is given while the vehicles are at a standstill, and they must start by their own means, but in certain cases a flying start will be allowed with the sanction of the stewards.

Art. 26.—The start shall take place in the order of entry, unless by special arrangement.

Art. 27.—In races upon the track the start shall be given to all the competitors at the same time, and this can also be done on the road; or the vehicles may be sent off at regular intervals between each competitor.

JUDGE AT WINNING POST.

Art. 28.—At the winning post there shall be one judge, and his decisions shall be final. If, however, there is a large number of competitors the judge is entitled to assistance, but the judge must be chosen by the stewards.

Art. 29.—The winning of a race is judged from the front of the front wheel for motor cycles and motor carriages alike.

Art. 30.—Should two or more competitors finish level the judge declares a dead-heat, and the two prizes shall be equally divided between the competitors finishing level.

Art. 31.—In distance races the competitor must cover the whole course in order to be entitled to a prize.

Art. 32.—In time races the competitors shall be placed according to the number of kilometers covered.

Art. 33.—When a single competitor starts a limit of time may be fixed by the stewards within which the course must be covered.

Art. 34.—Should a single competitor start in a race he shall have the right to the first prize.

OBSERVERS AT CORNERS.

Art. 35.—Observers chosen by the stewards shall be placed at the corners of the course to see that one competitor does not interfere wilfully or otherwise with another by wrongfully getting in front of him, or shutting him in, or by any other manœuvre which would be calculated to wrongfully affect the result of the race.

OBSERVERS IN ROAD RACES.

Art. 36.—In road races a certain number of observers shall be appointed and placed where it may be necessary to stop the competitors, or compel them to drive at a stipulated speed, and the observers shall see that these instructions are strictly adhered to by the competitors.

The French Racing Rules

TRACK.

Art. 37.—The measurement of the track shall be taken at 0.30 metre from the inside ropes. On all tracks the winning post must be indicated by a clearly indicated line.

Art. 38.—For the establishment of records on the track a certificate of measurement, with an annexed plan prepared by a qualified surveyor, shall be furnished.

GENERAL REGULATIONS RELATING TO RACES.

Art. 39.—Any competitor who in a race crosses in front of another, shuts in or obstructs another by any means so that the latter is prevented from advancing, may be stopped in the race or penalized by fine or disqualification, so long as the collision was not rendered unavoidable by a third competitor or the competitor who was obstructed was not himself in fault, but the fact that the collision was involuntary, or that it did not affect the result of the race, shall in no case be admitted as a valid excuse.

Art. 40.—No competitor shall be allowed to cross the course of another until he is at least two lengths of his machine ahead of such other competitor.

Art. 41.—No sign or advertisement shall be displayed on any vehicle while racing.

Art. 42.—No vehicle shall be pushed or assisted by any one other than its authorized occupants under pain of disqualification.

Art. 43.—Competitors shall be responsible for all civil and criminal penalties whatsoever.

SPECIAL REGULATIONS FOR TRACK RACING.

Art. 44.—A competitor wishing to pass another must do so on the outside, and so as to leave the competitor passed the following space from the rope, viz., for motor cycles 1.30 metres (4 feet), and for motor cars 3 metres (10 feet).

Art. 45.—A race containing too many entries may be run in heats, semi-final and final.

Art. 46.—The racing stewards shall arrange the heats, semi-final and final, and their decision shall be without appeal.

Art. 47.—No accident shall admit of a competitor running again, either in another heat or in the final.

Art. 48.—Any competitor leaving the track to get off his machine must start again from the point where he left the track.

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SPECIAL REGULATIONS FOR ROAD RACING.

Art. 49.—In road races the approach of a competing vehicle must be notified by a horn, trumpet, or some similar instrument.

Art. 50.—Vehicles which have to travel by night must display a white and green light in front and a red light behind.

Art. 51.—In road racing, competitors must conform to the traffic regulations of the police.

Art. 52.—Competitors must make themselves acquainted with the route, and no allowance will be made for mistakes they may make. Moreover, if any competitor takes a shorter or easier route than the one prescribed, he will be disqualified. The stewards shall be sole judges of the comparative distance or ease of the routes followed.

PROTESTS.

Art. 53.—The right of protest lays with the competitor, but the stewards can always interfere officially in case of necessity.

Art. 54.—Any competitor lodging a protest must always substantiate his grounds of protest, and the competitor protested against has the right of being heard in opposition to the protest.

Art. 55.—No protest will be considered unless it is put into writing. Protests must be considered by the stewards on the spot, and a decision shall be come to immediately, whenever this is possible.

Art. 56.—Protests shall be lodged at the times and in manner following: Protests as to classification of competitors and of machines, as to validity of entry and payment of entrance fees—before the race and verbally. Protests as to unfair running, errors of route, or any other irregularities on the route—within 24 hours after the race, and in writing. Protests as to the fraudulent starting of a competitor in a race for which he was not qualified—eight days after the race, and in writing. For protests in races on the road—eight days after the finish of the race.

PENALTIES.

Art. 57.—Penalties imposed on competitors in and organizers of races are recoverable immediately on their being notified to the parties concerned and on their publication in the journals officially notified by the Sporting Committee.

DISQUALIFICATION.

Art. 58.—If a competitor is disqualified in a race he loses all right to a prize.

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OFFICIAL AND PUBLIC REPRIMAND.

Art. 59.—A public and official reprimand is pronounced by the stewards or by the Sporting Committee of the Automobile Club de France, and involves the insertion in a public journal of an official notification by the Sporting Committee.

FINES.

Art. 60.—The moneys received in fines shall be paid into the funds of the Sporting Committee, to be distributed or devoted to sporting competitions.

II.—REGULATIONS AS TO RECORDS.

TIMEKEEPERS.

Art. 1.—The Sporting Committee shall appoint the official timekeepers and shall prepare a list of them every year.

Art. 2.—Timekeepers to be eligible for appointment must (1) possess a reliable chronometer stop-watch, certified as first-class by the Observatories of Besançon, Geneva, or Kew; (2) furnish the name of the maker of their chronometer stop-watch.

Art. 3.—The Sporting Committee may, when they see fit, require the timekeepers to renew the certificates as to their chronometers being first class. Certificates must be renewed every three years.

Art. 4.—The appointment of timekeepers is revocable at any time. Before appointment they must—

- (1) Submit to an examination permitting of the chronometrical test (a) of 10 tests of 500 metres (500 yards) and under; (b) of 10 tests of from 500 metres (yards) to 2,000 metres (yards); (c) of two tests of 20 kiloms. (15 miles) at least, or a test of 50 kiloms. (38 miles), the stop-watch showing the time of each lap and the time of the total distance.

In the above tests the candidate for appointment as timekeeper shall write down on the forms, of which a model is deposited at the offices of the Automobile Club de France, the times recorded by him. At the same time a certified official timekeeper shall make similar entries, but independently of the candidate. The candidate shall remit these forms, duly filled up, to the certified timekeeper in a sealed envelope. At the end of the tests the certified official timekeeper shall forward these forms to the Sporting Committee of the Automobile Club de France, together with the results of his own checking, certifying that the examina-

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tion has been properly conducted, and that there has been no collusion, comparison, or correction of results.

Art. 5.—The Sporting Committee shall decide on the appointment after examining and comparing the written results. A candidate who has been rejected may re-enter for election after a month.

Art. 6.—Timekeepers must sign the forms recording the times taken by them. Any timekeeper signing a record not made by himself will be *ipso facto* disqualified. He will also be disqualified by the simple decision of the Sporting Committee that his records have not been confirmed.

Art. 7.—The Sporting Committee takes cognizance of records on the track and road records. Each of these two categories comprises records of distance and of time, as well as the records for both categories defined by Article 9 of the Racing Regulations.

Art. 8.—The distances officially recognized for record racing are: On the track, 500 metres (500 yards); from 1 to 100 kiloms., per kilom. (1,094 yards); and for distances beyond 100 kiloms., per 50 kiloms. On the road: 500 metres; from 1 to 10 kiloms., by kiloms.; from 10 to 50 kiloms., by 10 kiloms.; from 100 kiloms., by 100 kiloms. The official distances in English miles: Distances of miles, 50 miles and 100 miles will be recognized.

Art. 9.—All races for records must be made from standstill, and vehicles must be started only with their own power.

Art. 10.—Races for records of 500 metres (541 yards) and of from 1 to 10 kiloms., inclusive, may be made by flying start.

Art. 11.—The time records of the Automobile Club de France are records by the hour without limit.

Art. 12.—The time records from town to town are also by the hour without limit (homologous).

Art. 13.—No record will be recognized as official unless it has been established over distances rigorously tested, and unless the time has been checked by several official timekeepers recognized by the Automobile Club de France.

TRACK RECORDS.

Art. 14.—Starts for track records shall take place from a tape.

Art. 15.—Attacks on the record shall be timed according to the laps round the track and by the hour up to 100 kiloms., by kilom., and by hour up to 200 kiloms., and by the 5 kiloms., and by the hour from 200 kiloms. upwards.

Whilst timing records timekeepers are expressly advised to

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take the times of the English distances at the half mile, mile, and all the military distances, especially the 10, 20, 30, 40, 50, and 100 miles, and above the last-named distance by the 100 miles.

ROAD RECORDS.

Art. 16.—Road records straight ahead are recognized from 1 to 50 kiloms., above that distance they are taken by the 50 kiloms. Road records permit of embracing the outward and return journey for all distances.

TIMEKEEPERS' FEES.

Art. 17.—Timekeepers are forbidden to accept any remuneration over and above the tariff fixed below, viz.: For a day, or part of a day, occupied in racing or in getting to and from a race, 30 francs (25s.).

Art. 18.—The traveling expenses of timekeepers are arranged by mutual consent.

Art. 19.—Every timekeeper must, at his own expense and on his own responsibility, procure such assistance he may require in working out his calculations, or for any other outside act or operation required, not strictly coming within the province of a timekeeper.

Art. 20.—Timekeepers may be temporarily suspended or have their appointment revoked for any act affecting their private or professional honor. Provided that this step cannot be taken unless by order of the Sporting Committee, after the accused timekeeper has been heard.

Art. 21.—No timekeeper shall be required to act as such for more than six hours at a stretch.

OPERATION OF THE REGULATIONS.

Special Article.—The present regulations shall come into force and be binding on all promoters of automobile races as from January 1, 1900.

ADDENDA TO RACING RULES.

The Sporting Committee of the Automobile Club de France believe they will be doing a useful work in bringing to the notice of organizers of road races, by means of its instructions and its opinions as regards road racing. The Sporting Committee being a branch of the Society for the encouragement and development of the automobile industry appreciate that the aim of holding

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trials and competitions under uniform conditions is to demonstrate the excellence or the faults of the various competing vehicles. The region of true sport has nothing to lose but everything to gain by looking thus upon matters which must tend to bind together all organizers of races, and to so arrange their programmes as to secure as much uniformity as possible. With regard to races of one stage only there should be no difficulties. If the starting signal is given to all vehicles at one time the task of the judge at the finish will be greatly facilitated. If the start and the finish are timed by chronometer the times can be taken with exactitude. The Committee recommend that only their official timekeepers should be employed in all cases.

According to the regulations as to records the only homologous times are those certified by the official timekeepers. For races in several stages the question is more difficult. As a matter of fact, it is certain that the obligatory stoppage and storing of vehicles in an enclosure in the town at which a stage ends add to the complication and also somewhat to the expense, but there is no other means of obtaining a reliable test. Moreover, if there is no enclosure a vehicle arriving at the end of a stage in a damaged state and virtually unfit to continue its journey on the morrow, could be repaired, and, so to say, thoroughly renewed during the night by a body of workmen. In this way a vehicle constantly under repair might start every morning in as good condition as one never needing repair. Such a result would be unfair from a sporting view, whilst it would be injurious from the point of view of the progress of automobilism.

Another point of some nicety is the following: It is clear that even the best vehicle in the world, after doing a stage of 200, 300, or even 400 kiloms., at high speeds, requires, before proceeding again, to have its principal parts tested, adjusted, cleaned, and lubricated, to have its reservoirs replenished, etc. It is necessary, therefore, to give competitors, both on arrival in the enclosure and before leaving, a certain time for looking to their vehicles. Therefore, to comply with the spirit of what has been said above, the competitors during this time ought only to give their vehicles the above necessary and reasonable attentions, but not to do any repairs.

The question is, where do these necessary and reasonable attentions end and repairs begin?—a very thorny question. Whilst it may be said that any fair-minded and competent persons can avoid being deceived, it cannot be denied that it is not practicable to fix a definite limit. The only practical way to steer clear of complicated regulations which it would be impossible to enforce

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strictly, and which would lead to endless disputes, whilst at the same time preventing trickery, is to allow a very short space of time for attending to the vehicle, both on arrival and before departure. For example, an hour on arrival and 15 minutes or half an hour before departure.

To effect this object it is understood that if a vehicle does not put in an appearance before the starter at its specified time, or is not in a fit state to start away when the signal is given, then its time is reckoned from the moment the starting signal is given, whether or not it is ready to start.

The arrangement and supervision of the enclosure should, therefore, have the most careful attention of the organizers and stewards.

As in racing by several stages the arrivals must necessarily be timed by chronometer, it seems natural to make the starts also by time. The first day the vehicles can leave according to the order in which they were entered, but the following day they will leave in the order in which they arrived the night before.

In road racing, whether in one or more stages, competitors are allowed every opportunity of effecting repairs on the road, but the time occupied in so doing is counted as their running time. However, in conformity with the ideas just expressed, the Sporting Committee strongly recommend the sealing of all the essential parts of the vehicles, such as wheels, motors, frames, etc. Naturally competitors must not be allowed to replace parts which have been sealed. Steps should be taken on arrival, and also at certain stages, to see that these sealed parts are in place, and any vehicle which is found to have any of these parts wanting will be disqualified from the race. The employment of lead seals which are liable to be pulled out on the way are not recommended in the case in question.

These precautions are particularly recommended with motor cycles, the parts of which it is so easy to change in the course of a race.

Organizers of road races must not forget that they must obtain the authorization of the prefects and the consent of the mayors of the departments and communes traversed. Often they will be obliged to bind competitors down to certain speeds over certain districts of the journey (in towns, dangerous portions of route, etc.). In this case they must take care to enforce on the competitors the exact observance of the specified speeds over these portions of the route.

The Sporting Committee earnestly enjoin on organizers to indicate fully and plainly to competitors the routes to be followed

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by means of notices, signboards, etc., to call attention to dangerous places, and to the places where speed must be slackened.

It is by the adoption of such measures intelligently carried out, and in accord with the local authorities, that accidents of all kinds may be avoided. Still it cannot be denied that these involve considerable work in long stages. These recommendations must not be taken as implying any modification of the regulations which provide that competitors take all risks and responsibility, whether arising from their errors or otherwise, and whether civil or penal, which may happen to them. The organizers, after having conscientiously done their best, must decline to accept any responsibility for errors of route which competitors may make, and leave entirely on their shoulders all responsibility, whether civil or penal, which they may incur.

Such are the broad lines which the Sporting Committee think should be adopted in the organization of road races to ensure order.

Additional Gordon Bennett Cup Rules

The Sports Committee of the Automobile Club of France have now published officially the rules attaching to any challenge for this trophy. They are practically identical with the draft as published by us in our January number. The only alterations are as follows:

Art. V. (ex-Art. IV.).—The exact date shall be fixed by common consent of the interested clubs before February 1st of each year.

Art. XVII. of the rules is replaced by the following: *Art. XVII.*—After confirmation of the results of the race, the cup must be handed to the victor within a fortnight. In case of a *dead heat*, and awaiting the settlement of any question concerning the *dead heat*, the cup will remain in possession of the club which previously held it.

In *Art. XVIII.* there is one slight modification to be noted. The suggestion was that the "walk-over" race was to be completed within 24 hours. The amendment states that it must be completed within a maximum time fixed by the Committee.

Art. XXII.—The cost of transporting the vehicles and their accessories, fuel, etc., shall be defrayed by the owners of the said vehicles, or by the clubs they represent.

Official Time-keeping Rules

AS will be seen from the translation of the racing rules drawn up by the French Automobile Club, and which we publish in our present issue, special regulations have been made to ensure that official time-keepers shall not only possess some technical qualifications, but also that their timepieces shall be of superior mechanical construction. No one at all conversant with time-keeping as practised at the various racing events both in England and France will, we think, affirm that it is as accurate as it might and should be, and when records are "timed" to the fifth part of a second—and this small interval of time will not infrequently cause the record to pass from one holder to another—it is seen at once how essential and necessary it is that the time officially declared as that occupied during an event shall be the true time interval. Those interested in records will perhaps be surprised to learn that, from the scientific point of view, very few of these records can be accepted as true time intervals, and, taking into consideration the very crude means employed at competitions, races, etc., to measure time, the best that can be said is that the time as deduced is but a rough approximation, which, owing to various errors that will be mentioned later, may be either very close to the true time or separated from it by a considerable time interval. When we consider that the ordinary official timekeeper is not required to pass any chronometric examination, neither is it required of him that he should have had any technical training or experience in the accurate measurement of time as practised in observatories or on board naval or telegraph cable steamships, and that the instrument he employs has in nearly all cases a variable rate, and, further, that the personal equation of the timekeeper and the rate of his timepiece are unknown, it will be seen that these so-called records can rarely be deemed correct measurements of time. For most purposes of sport an approximation is near enough, but for astronomical or navigating purposes the method of the official timekeeper would be wholly inadmissible. Still, there is no reason why cycling and motor vehicle contests should not be timed with at least some approach to scientific accuracy much greater than that which obtains at present.

For the accurate determination of a time interval we require a special observer and a special timepiece. Both are subject to certain errors, which may be ascertained and allowed for.

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As regards the observer, no two persons will observe the same phenomenon at the same instant. The difference between the actual time of an occurrence and its observed time constitutes the "personal equation" of that observer. This may be .1 sec. + or —, or it may be .5 sec. + or —. It varies in the same individual according to the state of health. In astronomical and physical observatories, surveying and cable steamships, where the accurate determination of time is essential to the proper performance of the work, this personal equation is always carefully ascertained for each observer. In order to show the influence that this very small time interval might exert upon a record, suppose we learn from the sporting press that a distance of 10 kilos. has been covered in 10 m. 40 s. by rider A. The same event takes place with another timekeeper, and rider B completes the distance in 10 m. 39 4-5 s., or, as we prefer to put it, following scientific usage, 10 m. 39.8 s. Subsequent testing of the observational powers of the two timekeepers reveals that the timekeeper for A has a personal equation of — .2 sec., while that of the timekeeper for B is + .2 sec. The corrected times would, therefore, be: A, 10 m. 39.8 s.; B, 10 m. 40 s. This case, although supposititious, is by no means impossible or unlikely. Nor are such personal equations as we have used unusual, as every astronomer or scientific navigator will admit. If, then, racing records are to be true records and not mere approximations, clearly the personal equation of each official timekeeper must be known, so that accurate comparisons of observed times can be made.

Dealing now with the instrument employed to measure time intervals, we should explain that no instrument keeps exact time—another surprising statement, and one that the official timekeeper will, no doubt, except to. Exact time can, however, always be ascertained providing the error and rate of the timepiece are known. By the error is meant the difference in time on a given date between the watch, chronometer, or clock in question and a standard clock or regulator synchronized from Greenwich, and the rate is the daily change in the error. If the latter be uniform, or fairly so, the time can always be ascertained with accuracy. Thus the problem of finding the longitude at sea consists essentially in determining the time at ship and noting at the instant of observation the time as shown by the chronometer, the difference between the two is the "meridian distance," which expresses the longitude. With a good chronometer and an expert observer very accurate results can be obtained. But in all time problems, whether they consist in timing a cycle race or determining the position of telegraph cable buoy in the middle of

Official Time-keeping Rules

the Atlantic, the absolutely essential condition is that the time-piece shall have a uniform rate. The "error" may be large or small so long as it is known; the rate may likewise be large or small, providing it is known, and that it be uniform, *i. e.*, does not vary. We perhaps labor this point, but we do so purposely. Now the marine chronometer is a very expensive instrument; a second-hand one good enough for ordinary navigation will cost not less than £20. In order to preserve a uniform rate the chronometer is carefully slung in gimbals and enclosed in an air-tight box, which is placed in another box, which is carefully cushioned. This latter box is then screwed down, and as far as possible the chronometer is kept free from all shock and vibration. The operation of winding is carefully performed at a stated time by a responsible person. No one but a qualified optician is ever allowed to touch the mechanism, not even to move the hands. Notwithstanding all these precautions an absolutely uniform rate, even in the best chronometers, cannot be ensured. The rate alters with temperature, and will not be the same at sea as in harbor. The variations are, however, usually very small, and it is quite possible to determine the time, either local or at Greenwich, with a limit of probable error of $\frac{1}{2}$ second, or even less. Now, our point is this. Seeing it is so difficult to ensure a uniform rate even in a specially constructed and expensive instrument as the chronometer, which will cost anything between £25 and £50, and considering also what care has to be taken to ensure fairly accurate results, is it reasonable to assume that a similar degree of accuracy can be obtained in a watch which may cost perhaps £5 or £6, or say £10, and which is daily subjected to a course of treatment which is diametrically opposed to that necessary for chronometers? If, as official timekeepers assert, they can obtain accurate results to the fifth part of a second with their what they so absurdly term "chronographs"—really they are nothing of the kind, because they do not furnish any "graph" at all—is it likely that such very commercial men as ship-owners would pay say £100 for a set of three chronometers for a steamship when, *pace* the official time-keeper, they could ensure equal results with a 5-guinea split-second watch?

Let us now consider the treatment a watch receives at the hands of such "experts" as official timekeepers. In the daytime it is usually worn on the person, and so exposed to the radiant heat of the body. Its temperature will usually be between 70° and 80° F., at times more. It participates in the oscillatory movement of the body, due to walking or riding. It also occupies a vertical position. At night-time it is usually placed on a table in

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a horizontal position, and exposed to the surrounding air, which may be anything from 30° to 80° F., or more. Obviously under such conditions a constant rate cannot be expected. As a matter of fact, the watch will lose in the day-time and gain at night-time. Even the best-made English watches would show a variable rate—often a *very* variable rate—under such conditions. Again, in the hands of the official timekeeper another cause of disturbance is introduced, and one which renders accurate timekeeping simply impossible. The more mechanism and movements the British watchmaker can crowd into a watch, the more the latter commends itself to an indiscriminating public, especially the official time-keeping portion thereof. Hence we have a wholly unnecessary split seconds movement, and the dial is divided accordingly, and the watchmaker and the official time-keeper delude themselves and the public that they can measure time to the fifth part of a second. “How wonderful!” says the unsophisticated. “How absurd!” says the scientific observer or navigator.

Now, a watch we may regard as consisting of a motor and a train of mechanism. This motor has no governor, but it is regulated so as to drive the mechanism at a more or less uniform rate; consequently, when we throw in gear the centre seconds movement we are putting more work on the motor, and so causing its rate of doing work to alter—in other words, we alter the time rate. Again, all mechanism possesses the quality of inertia; before that centre seconds mechanism acts an amount of time—it may be infinitesimal, but still an amount—has to be occupied in overcoming the inertia of the mechanism, and similarly in stopping the centre seconds movement, which action the official timekeeper *thinks* indicates time to the fifth part of a second, inertia still acts and tends to carry the movement on, and hence the angular displacement of the seconds hand is by no means, or necessarily so, a true time interval—it may have a limit of error of .2 sec. or .3 sec.

The centre seconds movement is rarely seen in watches in which accuracy of going is the desideratum. It is never seen in chronometers nor in Admiralty “deck” watches. At the same time the movement can be advantageously applied to ordinary watches and used to measure small intervals with some degree of accuracy provided the conditions necessary for accuracy are complied with. It will be seen then that a watch used as described is liable to three very serious errors before we can say that a record is correct to the fifth part of a second. We must know not only the competency of the official timekeeper as regards his ability to observe, but also the chronological efficiency of his

Official Time-keeping Rules

watch. Owing to the improvements in watch manufacture it is now possible to obtain watches that are really very accurate timekeepers. A watch may have passed the Kew test and may have the A certificate, but its subsequent good performance depends very largely upon the intelligent care bestowed upon it by its possessor. It does not follow that such a watch will be a good timekeeper *after* it has left the observatory, and hence time taken by it is not necessarily exact. Indeed, it is a wonderfully good watch that will maintain an efficiency of 50 per cent. in the Kew classification for a few months. The Kew certificate resolves itself into little more than that the watch to which it refers is of such mechanical excellence that if properly used the time will be correct within certain stated limits of error.

We have laid stress upon the importance of a uniform rate in any instrument used for the accurate determination of time intervals. We have shown how, even in marine chronometers, this rate is variable. In the best watches, even when used with every care, the rate can very rarely be guaranteed to remain constant for a few days. When used by lay and unscientific persons such as official timekeepers, a "rate" is quite out of the question. So far as the writer is aware, no watches are made having a split seconds movement which is used intermittently that can be relied upon to have a uniform rate. As the result of some considerable experience in rating chronometers and watches, he has found that even in the best watches the rate is usually very variable. It is in timing events that occupy some few hours that the influence of the rate is so important. Thus, suppose we are timing an event that lasts three or four hours, and are using a good watch that has a gaining rate of 5 secs. per day. Let the apparent time be one hour, then it is easily seen that this will be in error by .2 sec., or, in the nomenclature of the official timekeeper, $\frac{1}{5}$ sec., and in an event lasting four hours this will be .8 sec., or nearly 1 sec. of time. That this is no supposititious case will be admitted, when we say that it is quite a very common thing in using the very excellent "Admiralty deck watches" to find an error of half a second + or — during a period of, say, three hours during which the watch has been taken ashore for the purpose of taking observations.

Bearing in mind the many sources of error, personal and instrumental, which, as we have seen, the accurate determination of a time interval is liable to, even when trained observers and the best instruments are employed, it will be admitted that the determination of the time occupied in racing events by means of technically untrained men using comparatively very cheap watches

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with complicated and fancy mechanical movements must be liable to extremely large errors. In fact, such records as we see published in the cycling press are, from the scientific point of view, worthless, as they are merely "apparent times," and to render them "true times" they require to be corrected for many errors unknown as to sign and amount, the limit of error being certainly not less than 1 second and possibly $1\frac{1}{2}$ seconds.

In order, then, to obtain the time interval of a racing event, the competency of the timekeeper to observe should be determined by examination and his personal equation ascertained and checked on the day of the race; the watch employed should be compared immediately before and after the event with a chronometer (not a railway clock), whose error and rate are known. In this way a very fairly accurate determination could be effected, and one which would command respect as to its reliability.

The subject of time-keeping is one which might well occupy the attention of all racing bodies, but more especially of automobilists, and we trust that the Automobile Club will, in framing its rules for racing, take steps to ensure that the timekeepers are competent observers, and that the instruments employed comply at least with the Admiralty standard of excellence.

G. H. L., in the *Automobile Journal*.

AN INCREASING DEMAND

It is stated that the New York Central and Hudson River Railroad Company will replace its present cabs with the latest improved automobiles, just as soon as the new vehicles can be manufactured. The Lake Shore road, too, will discard its cabs in Chicago. It has placed orders for the new vehicles with the new \$10,000,000 Woods Motor Vehicle Company, recently incorporated in New Jersey. Vice-President J. Wesley Allison, of the Woods Company, says he also has orders from Manager Boldt, of the Waldorf-Astoria Hotel, for automobiles for his hotel service.



Floral Parade of French Auto Club

One Year's Progress of Automobilmism

By Félicien Michotte

I AM very much tempted to say, and should like to be able to say, that 1899 has been the year of triumph of automobilism in France; but if I did say so, I should be no longer able to say so after 1900. For, without being a great prophet, I foresee that what has been done in 1899 is but a trifling matter as compared with what will be accomplished in 1900, from the viewpoint of manufacture and sales, and especially from that of the general adoption of the automobile in France. The number of these vehicles in use at present in Paris alone is more than three thousand.

The automobile has now thoroughly entered into the French mode of life; timorous persons no longer exist; the sight of an automobile running in the streets no longer attracts any attention; and a break-down alone causes the gathering of a crowd, and that of much smaller size than one that is collected by the falling of a horse.

Odors no longer call forth protests, since people have grown used to them. Horses have been pleased to put themselves upon

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a level with man (and for this the poor pedestrian should be thankful to them) and no longer take fright or even shy at mechanical or other street cars that come toward them at 15 miles an hour, and graze their nose at such speed. The noise made by petrolettes, motorcycles, quadricycles, etc., leaves everybody (even dogs) indifferent, and it may be said that the horse, the dog and man are now trained.

Another progress made by automobilism in its entrance into our mode of life is seen in the theatre. For example, in a piece put upon the stage by the "Variétés," one of the principal incidents is an accident that happens to the automobile of the Prince, and which is followed by a happy denoument for the latter, the piece and the author.



Racing Van at Timing Station

In a lecture delivered three years ago upon the future of automobilism, I said: "Our fathers judged of the wealth of a person by the criterion, 'he has a horse and carriage'; in a near future, in the second year, he has an automobile." I did not know that I was saying a thing so true and so soon to become a reality; for it may be said that nearly every wealthy person now has an automobile and those who have not, have one ordered from some manufacturer, and, as the saying is, will have to wait months and months to have it delivered, so great is the demand for these vehicles.

The middle class, the bourgeoisie, has adopted the voiturette and the quadricycle, which are within easier reach as regards

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purchase price, and this latter, like the automobile, leaves the public absolutely indifferent, so many prices are there.

Is it necessary to say that the cycle has done nothing but grow and become handsomer; that new adepts are counted by thousands every year, to the great profit of the Treasury, which taxes them 10 francs; that the Monts de Pieté (pawn-broker establishments) have been obliged to provide vast installations for the housing of bicycles during winter, since it appears that it is cheaper to borrow from one's "uncle" than to put a bicycle in storage; and that the members of the Automobile Club now number more than two thousand (despite the distinctly "aristocratic" character of the association), and more than the Touring Club includes at present.



The Goal

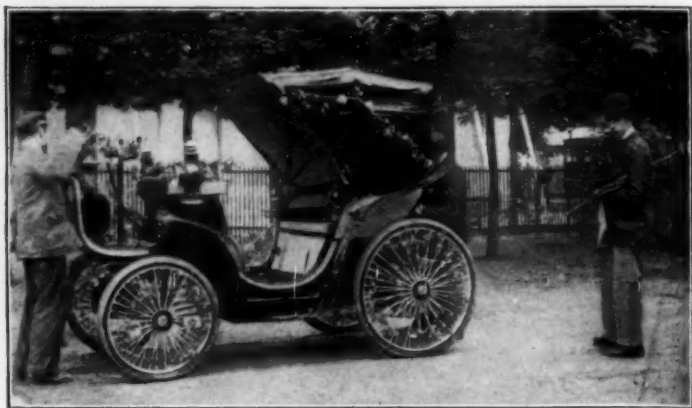
MOTOCYCLETTES

The Werner Motocyclette, a bicycle which carries in front a diminutive motor of the De Dion system, has some adherents; and several manufacturers have been endeavoring to push it, but, so far, without much success. This type of vehicle does not appear to me to have much chance of coming into general favor.

MOTOCYCLES

The manufacturers of the motorcycle have increased in number, but the general character of the vehicle has not changed. It is always the De Dion motor that holds supremacy. A few Gladiator motors and several derivatives from the De Dion have followed in its train, but very unassumingly.

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Decorating a Peugeot Victoria

This year, we have seen the De Dion motor of $1\frac{3}{4}$ horse-power, which is merely that of $1\frac{1}{4}$ horse-power with a slight increase in internal diameter; then the 2 horse-power, and finally the $2\frac{1}{4}$ horse-power motor—always the same, with a slightly increased bore. Ere long, we shall have the $2\frac{3}{4}$ and also the $3\frac{1}{4}$ horse-power; but that will cost nothing but writing, since such powers exist only upon paper.

An exceptional motor that I tested, and which was called $1\frac{3}{4}$ horse-power, gave $\frac{3}{4}$ horse-power with difficulty, and a $2\frac{1}{4}$ horse-power gave one only, and even that was doing well.

Chainless tricycles or "acatenes" have been constructed; the De Dion surface carbureters have been replaced by certain others, such as the Longuemare vaporizing apparatus or analogous ones; the forms, complications and dimensions of lubricators have increased, and gasoline reservoirs have assumed gigantic proportions, which do not ornament the tricycle as seen from the rear, but far from it. Let us hope for the sake of æsthetics that a halt may be called here, lest the motocyclist have the appearance of having a manufactory at his back.

MOTOCYCLES AND VOITURETTES

The voiturette coupled to a motorcycle came and had a certain run; but, unfortunately for it, the quadricycle, which is less costly, caused it to be abandoned. The latter is less cumbersome, and is stronger, and presents to the eye more solidity and stability.

One Year's Progress of Automobilmism

QUADRICYCLES

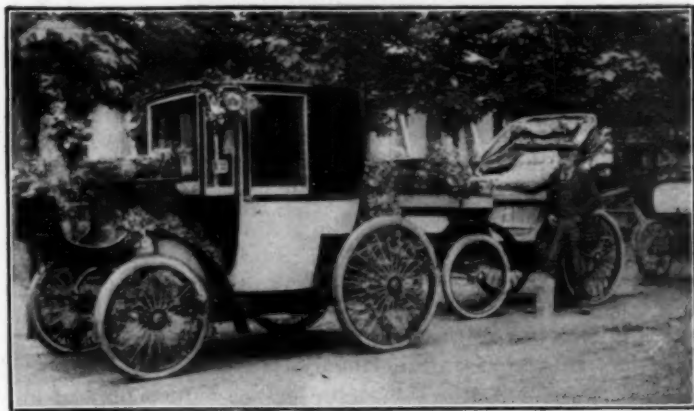
The quadricycle presented itself in the form of a front hauler of the Chenaud system, with a seat upon two wheels, which were situated at the place of the front wheel. It was a success, and a well merited one for the modest inventor. Such success involved the construction of the quadricycle now so much employed. It is handsome and practical, and permits of a conversation being carried on between a lady and gentleman, and does not make it appear as if the lady were being driven by a servant. This vehicle is destined to be still further developed, for it is more within the reach of many purses and less cumbersome than the voiturette.

The "Victoria Combination" voiturette is a vehicle intermediate between the quadricycle and the voiturette. It is the back of a motorcycle turned about and forming but one with a voiturette seating two persons. It is pleasing to the eye and has achieved a certain amount of success.

VOITURETTES

The voiturette has quite a number of new manufacturers, but, notwithstanding this, remains stationary, since the price of it is somewhat high; and fault is found with some of the types that they are poor hill climbers and do not afford sufficient speed.

Voiturettes, with a few rare exceptions, have all been actuated by De Dion motors, and are, for the most part, "carriage-finished" motorcycles, if I may so express myself.



A Decorated Coupé

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The Decauville Voiturette, pretty and graceful, is provided with two coupled De Dion motors; but it is feeble as to motive power, and lacks strength. Nevertheless, there is a certain demand for it.

The voiturette with front-hauler, heavy and ugly, and perhaps more powerful, has not had the success of the other types. On the contrary, the little two or three passenger "Voiture" De Dion (for such is the name that has been given to it) has had in its favor its pleasing aspect and the name of its manufacturer. The Bollée "Fameuse" Voiturette seems to be becoming more and more neglected.

The hit of the year is a voiturette which has received no puffing, but which has in its favor the possession of a motor of



De Dion Bouton Steam Stage in Operation

4 horse-power (at the brake), without a circulation of water, and yet is a vehicle that *climbs*. It is the Niullary Voiturette, light and handsome, which by the next year will find a ready sale.

CARRIAGES

The gasoline carriage has this year made a great advance. Its form has been improved, and it has become lighter, more elegant and nearly silent.

We now see running a few landaus, one or two hacks, several coupés, some dog-carts and phaetons, and a large number of omnibuses. The vis-à-vis type has been nearly abandoned.

One Year's Progress of Automobilmism

Motors have remained *in statu quo*, but have become of 6 and 8 more or less effective horse-power. It is always the Phenix, Panhard or Peugeot that take the lead.

Many small engine builders have been desirous of engaging in the construction of automobiles, but all have desisted after perceiving that the construction of a motor carriage is not so simple a matter as it might seem to be, and that if certain persons, such as Panhard and Peugeot, have the precedence it is because they have justly merited it. In their train follow Delahoye, Mors, Hunter, Rochet, etc.

Some attempts at importation have been made, and that by the American builders of the Duryea carriage, Locomobile and Columbia. Manifold (though fruitless) attempts have been made to extend the patents on these vehicles; but, despite their real value,



Replenishing Station for French Autocars

the purchase of foreign patents at a phenomenal price would be a mistake that our manufacturers would be slow to commit.

STEAM CARRIAGES

Among steam carriages, we have witnessed the development of "heavy weights"; the De Dion traction carriages have been used upon the Metropolitan Railway for drawing cars loaded with excavated material; and a Scotte steam truck has been seen running in the streets of Paris.

As regards pleasure carriages, the "Hawley," an American vehicle, has had some success as a matter of curiosity; but that is about all. It is very well arranged, but lacks strength and is too

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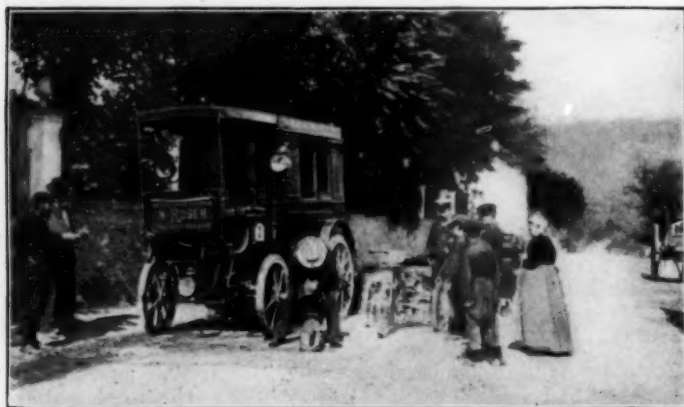


Steam Truck During Heavy Weight Contest

complicated, and will not come into favor, since many persons will be afraid to sit over a steam boiler registered at 170 pounds to the square inch. I pity the person whose duty it will be to make the connections and keep the joints tight.

ELECTRIC CARRIAGES

After being successfully launched, so to speak, the electric carriage has finally started off. It has proved a great success in France, despite the general lack of charging stations.



A Steam Bus at Standstill

Mechanical Propulsion and Traction

By Prof. G. Forestier

Third Paper

For the transportation of heavy indivisible masses that exceed in weight the load that can be economically imposed upon the usual team of five horses in tandem, inventors, discarding the automobile truck, have for a long time been incited by traction upon rails, and have devised mechanical vehicles for hauling independent trucks.

The reasons for the final failure of all regular systems of hauling upon roads are twofold :

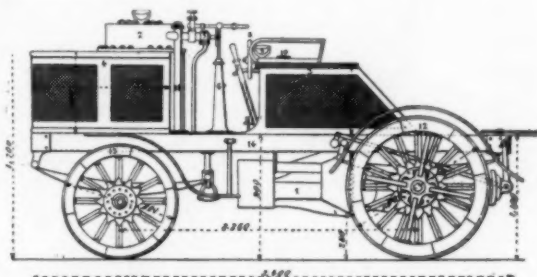


Fig. 12. The de Dion and Bouton Steam-Power Carriage

(1) With a high speed there is a certain difficulty in maneuvering without hazarding the stability of the vehicle hauled, but especially a danger from the failure of the brakes to act in unison. Such are the causes for which, without speaking of a blinding dust, passenger trains upon roads are limited to quite a feeble speed, in order to prevent the inconveniences of attaining a dangerous one, but which is then inadequate to satisfy the requirement of going fast.

(2) For the carriage of merchandise at a slow speed the use of a vehicle for hauling loaded trucks would not constitute an economical application of mechanical traction.

In fact, let us see what takes place upon railways themselves. Although the hauled train is the rule upon plains, where the line presents only similar levels, the tendency, in a mountainous dis-

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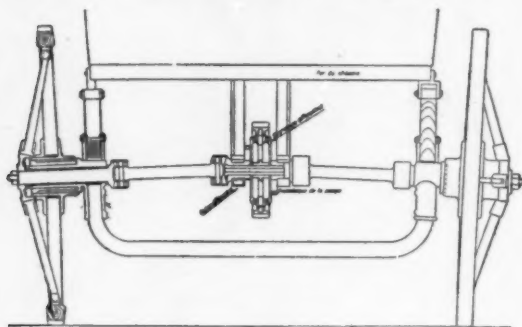


Fig. 13. Arrangement of Driving-wheel Gear of the de Dion and Bouton Power Carriage

trict, upon a line with a broken profile, where the gradients reach .4 of an inch to the foot, is to have recourse to the automobile vehicle.

The locomotive upon a line on which the maximum declivities vary from .08 to .12 of an inch to the foot hauls from *ten to eleven times* its weight. If the declivities are from .12 to .16 of an inch the load hauled descends to *eight or nine times* the weight of the locomotive. If they reach from .16 to .2 of an inch the load hauled falls to five or six times the weight of the locomotive. At from .3 to .4 of an inch the weight of the train reaches scarcely one and a half times that of the locomotive. Beyond this the latter would hardly be able to haul its tender.

Now, upon a road, although the coefficient of resistance to the rolling of the vehicle varies from 44 to 88 pounds per ton, owing to the fact that the coefficient of sliding friction is higher than it is upon rails (0.35 instead of 0.14), a mechanical vehicle will nevertheless be able, upon a level, to haul two or three times its own weight at a low speed. But upon many roads we meet with declivities of .5, .6 and 1 inch to the foot, and upon these the resistance of the vehicle hauled will be doubled or tripled while at the same time the power of the traction engine will be diminished by so much.†

† It results from experiments made with an Aveling and Porter road locomotive of 6-horse power, weighing 13,440 pounds, that it was capable of hauling:

On a level and on a good road.....	five times its weight.
Upon a 4% declivity and on a good road.....	three " "
Upon a 7% declivity and on a good road.....	two " "

—but that, in regular service, it had to be made to haul only $\frac{2}{3}$ of these experimental maximum loads, that is to say:

On a level.....	3.33 times its weight.
Upon a 4% declivity.....	2.25 " "
Upon a 7% declivity.....	1.31 time its weight.
Upon a 10% declivity.....	0.66 " "

Mechanical Propulsion and Traction

At all events, the police regulations as to transportation do not permit a four-wheeled vehicle to exceed a weight greater than 16 tons. Hence, upon a somewhat broken road, the load hauled will not sensibly exceed that which a team of five horses may be made to draw economically.

In order to solve the problem of the mechanical traction of any load in bulk exceeding the normal and economical power of the draught animal without necessitating the construction of a special automobile truck in each particular case, we see only the following arrangement: The mechanical vehicle should be arranged in such a way that it can be used as a fore-carriage for the truck, upon which would be placed the indivisible load, as if animal traction were to be employed. This fore-carriage may evidently be provided with two, three or four wheels. In the first case the fore-carriage will be wholly for steering; in the two others the front wheel in the tricycle and the two front wheels in the bogie fore-carriage will be used for steering.

This type of mechanically propelled vehicle, in which a portion of the load to be hauled contributes toward giving the driving wheels the necessary adhesion, has been particularly studied and improved by MM. de Dion and Bouton.

It was a traction vehicle of this kind (Fig. 12) which, running isolatedly, was the first to arrive in the race organized between Paris and Rouen by the *Petit Journal* in 1894.

Further along we shall give the necessary details as to its boiler, motor and transmissions. For the moment we shall be content to state that the transmission of power to the driving

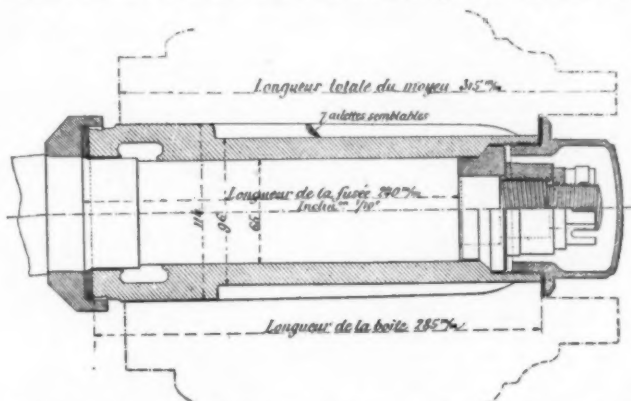


Fig. 14. Patent axle-journal used by the Compagnie Générale des Omnibus of Paris

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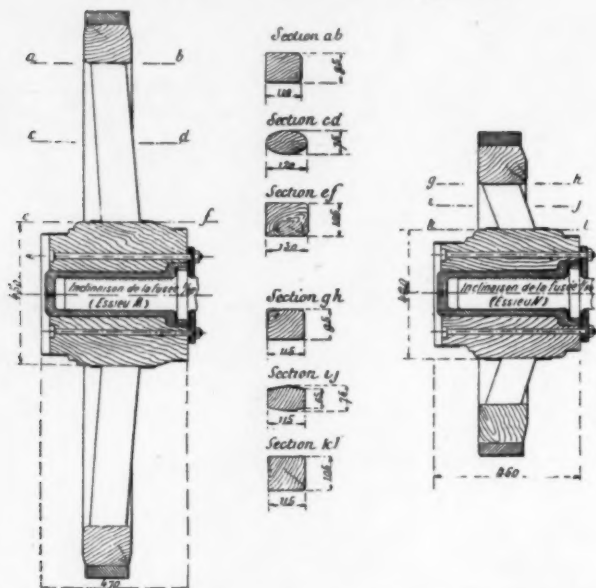


Fig. 15. Patent axle-journals used on the Trucks of the Say Refinery

wheels is effected through the intermedium, not of a chain, but of a cardan joint placed between the axis of the differential gearing and the axle journal (Fig. 13).

We cannot refrain from saying a word as to the *gasoline carriage*, which, entering seriously into the lists with the Daimler motor, along about 1890, has more powerfully aided in the development of automobilism than the very persevering and interesting efforts of those inventors who have successively occupied themselves with the improvement of the steam carriage.

At the Exposition of 1889 MM. Panhard and Levassor exhibited an omnibus upon rails which was actuated by a Daimler motor. In 1891 a Peugeot carriage, provided with a motor of the same type, participated, it appears, in the Paris-Brest race. Yet in 1892 an editor of *La Nature*, in giving an account of Prof. Unwin's experiments with gasoline motors, mentioned pleasure navigation only as an interesting application of this new motor.

Specially translated for the Automobile Magazine from *Le Génie Civil*.

(To be continued in our next issue.)

The Automobile in Local Transit

By Sylvester Baxter

ONE of the most vital problems relating to the modern municipality is that relating to local transit. The development of the automobile bears upon this question in two important ways. One of these replaces an existing form of animal-traction service and the other supplements a highly developed form of mechanical traction. Each has the advantage of a greater flexibility in operation than the corresponding methods in existence. The first, a motor-cab service, is already in a well advanced stage in our great American cities. This may be called the individual aspect of automobile local transit, giving to a person at a moderate charge all the advantage of a privately owned carriage; taking the passenger, as it does, from his own door to any spot that he may desire to reach. No investment is required on the part of the individual; the vehicle company assumes all the care, repairing, cost of charging, etc.; and with a telephone in his house or office a person may bring to his door at any moment what practically amounts to his own carriage. While, of course, there is a manifest economy in the possession of one's own automobile when it is wanted for regular use every day, for a very large number of persons—particularly those who live in cities—the hired vehicle will prove highly economical, and we may expect to see an enormous increase in the use of the motor-carriage for individual business and recreative purposes, such as errands to sections of a city not reached by the ordinary transit routes, pleasure-drives in the parks and suburbs, etc. The celerity of the motor-vehicle, its easy motion, its tirelessness, the free views on all sides, make it an ideal form of recreative conveyance, and with its growing availability we may expect to see a very great increase in the number of those who patronize livery carriages. An economic aspect of this form of service lies in the fact that the capacity of the plant is so much in excess of an aggregation of a corresponding number of privately owned carriages, each one of which is used, as a rule, only by the person or the family possessing it. But when a company owns the same number of vehicles for hire, they are naturally in use by a very much larger number of persons and consequently make a much greater

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return on the investment in the way of utility, which in the matter of the commercial company is equivalent to profit. This suggests the desirability of what may be called a modified form of private ownership in the shape of collective ownership on the part of groups of individuals. For instance, a number of persons might act coöperatively by clubbing together and purchasing any desired number of motor-vehicles to be kept for their common use as required. In this way there would be a material economy in expenses for stabling, care, charging of batteries, experienced drivers, etc., while a greater variety of vehicles would be at the disposal of the individual. Such a function might be assumed by automobile clubs to the advantage and convenience of their members, and we may expect to see a great growth of clubs for this very purpose, with membership as large or as small as may seem desirable. It is a common custom for boat and canoe clubs to own various kinds of water-craft for the use of their members, and there is no good reason why an automobile club should not follow the example. In this connection it may be suggested that a highly popular feature for a golf-club would be the ownership of automobile conveyances to take its members to and from the links. This was proved last year at Newport.

The public aspect of automobile local transit is represented by the motor-omnibus service, now in successful operation in various European capitals and in the near future to be installed in several great American cities. The possibilities of automobile omnibus lines is something enormous, and there is probably no more promising field for the profitable application of the principle than is offered in this. While it cannot be expected that this form of traction will to any degree supplant the tramway method, in all probability the motor-omnibus will rival the street-railway to a considerable extent, as it certainly will supplement the latter most conveniently. Moreover, it can easily be made a most valuable auxiliary to a street-railway service. A street-railway system, of course, has the advantage of larger vehicles than are practicable for motor-omnibuses, as well as that of a higher rate of speed. For in the former the element of guidance, so far as steering is concerned, does not appear, and the matter of control being therefore limited to fewer particulars, a higher speed in city streets is practicable, as a rule, than where the matter of direction enters very largely into consideration. But these advantages are counterbalanced by certain factors that tell in favor of the motor omnibus. The latter has a much greater flexibility than the tramway system possesses. If a street-car breaks down it brings to a stand every car behind it until the way is

The Automobile in Local Transit

cleared. The same interruption occurs in the case of a blockade of the street for any reason—from the collapse of a heavily loaded team—and loaded teams seem invariably to have the perversity to choose the car-tracks as the scene of misfortune—to the congestional effects of processions, circus-parades and gas-main explosions. But the breaking down of a motor-omnibus can have no effect on the other vehicles of the line, and in case of the blockade of any portion of the route the traffic can at once be diverted around through other streets for the time being. The motor-omnibus can also take the fullest advantage of improved forms of pavement. An asphalt pavement, for instance, converts the entire street-surface into what for the motor-vehicle is practically one broad rail of indefinite width—or what is the equivalent of a rail in every property except that of guidance. It can skillfully thread its way through the tangles of a crowded thoroughfare where the street-car is constantly brought to a halt by this or that interruption. So, even in the matter of speed through the busy streets of a city, the motor-omnibus will be found to have the advantage over the street-car. Another point in favor of the former is its greater directness. A street-car line between two cardinal points—such, for instance, as terminal railway stations on opposite sides of a city—makes its route as devious as possible—going the longest way around so as to pick up the greatest number of passengers practicable. An omnibus line, however, having for its special object the conveyance of passengers between two such points, would take the shortest cut across and get its patrons to their destination in the quickest possible time. As to elements of profit—while a motor-omnibus cannot carry anywhere near the number of passengers that a street-car can, and while a storage-battery system is much more costly in operation and maintenance than a trolley system, on the other hand the motor-omnibus is entirely free from the very costly factor of construction, maintenance and renewal of track—items that consume a very large proportion of the capital and the receipts of a street-railway company. For the motor-omnibus line the traction surface is provided by the public. And when we consider what enormous profits a street-railway would make were the element of rails, roadbed, trolley-wire, return-conduits, etc., eliminated, it may be imagined what a field for investment is offered in the establishment of motor-omnibus lines in the cities of this country.

It is safe to say that the prospective demand in this direction alone is sufficient to exceed enormously the capacity of all the existing manufacturing facilities in this country were they con-

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fined solely to that special feature, instead of being overrun with orders for motor-vehicles of every description.

There are three cities in North America where lines of automobile omnibuses will be in full operation before the end of the present year, and each of these present exceptionally favorable opportunities for the purpose. These are New York, Boston and Mexico. In the City of New York, Fifth avenue, with its magnificent extent of asphalt pavement unbroken by car-tracks, offers a superb opportunity for the profitable operation of such a line. And this has been taken advantage of by the purchase of the Fifth Avenue Stage Line—so long celebrated for its decrepit horses, the butt of the caricaturists—by interests connected with the great Electric Vehicle Company. This will be the pioneer electric omnibus line of the continent, and the change will mark the beginning of an important epoch in local transit matters for this country.

In Boston there have lately been some remarkable transit developments. While fundamentally they have to do with broad principles of municipal administration, incidentally they have a very important bearing upon automobile interests. It is manifestly important that every city should have at least one great thoroughfare unobstructed by car-tracks. New York has such a street in Fifth avenue, and as a civic possession it is priceless. Boston is now assured the permanence of such a thoroughfare, or continuous line of thoroughfares, running into the very heart of the business section. It may be remembered that the celebrated Boston Subway, that carries the street-car traffic underground through the congested section of the city, was the result of an agitation to prevent the venerated Common from encroachment by street-railway tracks. When this great enterprise was authorized it was provided that upon its completion the car-tracks should be removed from Tremont and Boylston streets around the Common, and from the former throughout the rest of its surface to its terminus at Scollay square. The tracks had been removed but a few weeks when the Boston Elevated Railroad Company, which practically monopolizes the local transit service, instituted an agitation for their restoration. This agitation was ostensibly in the interest of the "masses"—and much was said about the poor shop-girls, who desired to be conveyed to their shop doors in inclement weather, etc. It was supposed to be a popular measure, and every daily newspaper but one, and the great majority of the politicians, were vociferous for the change. Legislation to restore the tracks was secured, but a threat of a veto from the Governor led to the incorporation of a provision that the question

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be left to a vote of the citizens. When the time for the vote drew near, at the annual municipal election in December, a public-spirited citizen, Mr. B. F. Keith, the theatre manager, came forward and headed the movement against the restoration, contributing freely of his means and devoting his energies to the work. In his popular theatre the cinemetagraph presented the arguments in favor of keeping the tracks away from the streets with telling directness, showing the street in its former insufferably congested condition and in its present dignified aspect. The *Evening Transcript* also did yeoman service in the work. The result was a great civic victory for municipal development on correct lines. The longer the tracks were off the streets the better the public liked the effect. The people saw through the motives of the newspapers and of the politicians, and they buried the proposition under a great adverse vote of practically two to one—nearly 52,000 against and a little over 26,000 for, only two wards voting in the affirmative. So Tremont and Boylston streets remain stately thoroughfares, soon to be paved with asphalt and free to use by all freely moving vehicles.

This very notable demonstration of civic sense on the part of a great city's population has such an important bearing on the adaptation of our cities to the great reforms that are impending in their transit methods with the advent of the automobile, that the foregoing concise review has its place in these columns. And it will not be amiss to chronicle an amusing episode of the campaign. A certain Commoncouncilman, a ward politician, made a speech on the subject to the following effect: "I am in favor of putting the tracks back on Tremont street, because the people want them back! I am in favor of putting them back because B. F. Keith does not want them back. B. F. Keith is opposed to putting them back for the reason that he has on Washington street an entrance to his theatre to which the poor people and the common people are brought by the street-cars. He has an entrance on Mason street where his wealthy patrons come in their carriages. And now he wants Tremont street kept clear of the car-tracks in order that the aristocrats of the Back Bay may roll up to his door in their automobiles!"

The determination of the future of Tremont street has indeed given a great impetus to automobile development in the direction just considered. The Boston Transit Company, one of the subsidiary companies of the Electric Vehicle Company, had evidently been awaiting the action of the public on the question. No sooner had it been determined that Tremont and Boylston streets

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were to remain unobstructed, and therefore ideal thoroughfares for automobile use, than the company petitioned the Board of Aldermen for the privilege of running lines of motor-omnibuses over three important routes, two of which included Tremont and Boylston streets. Electric omnibuses, of the same pattern as those designed for Fifth avenue in New York, are to be placed in service as soon as they can be made ready. One of these routes is intended chiefly for recreative purposes, although incidentally it will serve residents along the way. Whether this route will be operated depends upon the action of the Park Commissioners, for it lies chiefly within the jurisdiction of the Park Department. The Boston Park Board expressly disclaims any hostility to the automobile, but holds that the time has not yet come for a relaxation of the restrictions. In the interests of all concerned, however, the park board should look favorably on the proposition.

The third city which offers remarkable opportunities for automobile transit is the stately capital of Mexico. Conditions of climate, topography and population are alike favorable. The streets are level and smoothly paved, and, of course, are never obstructed by snow, while the public gives a most profitable patronage to local transit lines. The Broadway of Mexico, described by George Augustus Sala among his pen pictures of the famous streets of the world, comprises in a great central thoroughfare the successive streets known as *la calle de los Plateros*, the first, second and third *calles de San Francisco* and the *punte*, or bridge, of the same name, and the Avenida Juarez, to the magnificent pleasure drive of the Paseo de la Reforma, with its statues, monuments and splendid promenades extending out to the castle of Chapultepec. In the central portion of the city the streets included in this magnificent thoroughfare are too narrow and too thronged to admit occupation by street-cars, but the whole extent from the national Palace on the Plaza Mayor to Chapultepec, a distance of something like four miles, offers a superb route for the motor-omnibus line soon to be established by the Electric Vehicle Company of Mexico, a corporation allied with the great company of a similar designation in this country.

Couthon's Automobile

A Relique of the Last Century

IT is not known to everyone that Couthon, the French revolutionary fanatic who died on the scaffold with his friends and colleagues St. Just and Robespierre, was the possessor of a mechanical carriage in which some of the features of our modern automobiles have been anticipated. Like Scarron, the creator of French burlesque, who lived a century before him, Couthon was paralyzed in both legs. Both the revolutionist and the burlesquer, although physically disabled, were men of rare talent.

Nevertheless, the lives which they led were different. Scarron could devote himself to his literary and intellectual work in the privacy of his study, seated in a stationary chair, and could discourse at his ease with the brilliant men to whom he communicated his original ideas. Couthon, however, lived in more active times. The Convention, not the home, was the place for a gifted man during the Revolution; and in order to travel between the assembly hall and his house, he employed a vehicle, which to this day is preserved in the Musée Carnavalet.

Couthon's carriage, or chair, is a true automobile, although driven by hand. Its construction is as simple as it is ingenious, and is just as remarkable as that of the Ozanam carriage (called so, probably, because it was built by Elie Richard).



Couthon's Autochair

The carriage has two vertical shafts provided at their upper ends with hand-cranks, and at their lower ends with cog-wheels, which engage pins projecting laterally from the carriage-wheels.

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Here we have the germ of the modern automobile driven by a motor coupled with the front axle—the *avant-tram moteur*.

The vehicle is easily steered by turning one crank more rapidly than the other. By turning both cranks in opposite directions, it can be swung around as upon a pivot.

One naturally wishes to know the name of the inventor of this curious, old mechanical chair, and the date of its construction. Were similar vehicles in use, or is this the only one of its kind? Unfortunately, no light can be thrown upon this point. The chair, it is said, was lent to Couthon by the *Mobilier national*, and came from Versailles, where it had been used by the Comtesse d'Artois.

Was it built especially for her? Was the inventor the Comte d'Artois himself, or perhaps Louis XVI., who, as everyone knows, was a skilful locksmith? Or was it merely an imitation of a model already in use, of that, for example, which formed part of the effects of Abbé D——, and which in 1785 was advertised in the *Annonces-Affiches* as a "joli fauteil monté sur trois roulettes, propre pour une personne infirme qui, au moyen, des manivelles, peut se promener dans sa chambre ou dans son jardin" (a fine chair mounted on three small wheels, suitable for an invalid who, by means of cranks, can ride about in his room or in his garden). Chi lo sa?

THE OPEN ROAD

In a recent issue of the *London Spectator* there is a charming article on the "Open Road," in which the delights of travelling by road are dwelt upon. The article concludes as follows:

"We may be sure that before very long the roads of all countries will obtain, socially and commercially, an entirely new significance. The bicycle has restored the roads to the pleasure-seeker; the motor car and motor wagon will restore them to the non-athletic lover of the open air, and to the trader. The new century will see the railways relegated to their proper place as providers of very swift and very heavy transit, while the roads, which have always this advantage that they pass all men's doors, will once again be thronged by carriages and carts. In a few years' time the man of business who lives six or seven miles out of London will never dream of taking, as he does now, a fifteen-minutes' drive in a carriage to the station, then twenty minutes in a train, and then ten minutes more in a cab, to reach the office. Instead, he will drive from door to door in a motor victoria, and save money, time, and temper."



Compressed Air in Europe

THE delivery-wagon represented herewith, constructed by Messrs. Molas, Lamielle and Tessier, was exhibited at the second Exposition des Tuileries, where it attracted considerable attention by reason of the relative simplicity of arrangement of its maneuvering devices and the limited amount of space occupied by the motive apparatus.

In this vehicle, the air-storage reservoirs employed consist of hammered steel tubes of 8-inch external diameter, the ratio of the weight of which to that of the air stored up is $\frac{1.18}{2.5} = \frac{1}{4.36}$. The heating is done directly by gasoline, instead of by steam from a boiler, as in the Mekarski system; the manufacturers being of the opinion that, since a direct heating of the air permits it to be raised to a temperature much higher than that which could be obtained by means of heating by steam, they obtain also a greater increase of volume and, consequently, of work that compensates for the heating during expansion obtained with the above-named system.

The stove, burners and gasoline reservoir used for heating have here a feeble weight as compared with the arrangement in

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which a boiler is employed. The ratio of the weight of air stored up to that of the reservoirs and heating apparatus does not descend below $\frac{1}{4.35}$.

The air reservoirs are eleven in number and are distributed in two groups, one of six forming the "battery," and the other of five constituting the "reserve." The capacity of these groups is, respectively, 11 and 7.5 cubic feet, or, altogether, 18.5 cubic feet.

With a charging pressure of 4,290 pounds to the square inch, the weight of air stored up, at a temperature of 13°C , is $1,100 \times 2.7 \times 638 = 392,370$ pounds.

Before its admission to the cylinders of the motor, the air passes into a steel worm of .28-inch internal diameter, of .14-inch thickness, and of a length of 19.7 feet, which raises its temperature to a figure that varies with the discharge of air and the intensity of the burners that heat the worm. The temperature may thus reach 150°C . The air afterwards passes into an expander (maneuvered by the driver), which lowers its pressure by about from 11 to 44 pounds, according to the difficulties of the road, the load and the speed. This expansion of the air gives rise to a lowering of the temperature, in order to raise which, the air thus expanded is made to pass into a second worm concentric with the first and heated by the same burners. When the air makes its exit from this second worm, its temperature may be as high as 250° . It is claimed that this double heating is capable of more than doubling the volume, and, consequently, the work of the air stored up. This air is then admitted to the cylinders through an expansion distribution with a special change of speed. The admission takes place upon only one of the faces of each piston, and the motor is thus a single acting one. But the cylinders are four in number, and cast in pairs, and the connecting rods (jointed directly to the pistons) actuate the same shaft, the cranks of which are set at an angle of 180° per group, and at 90° from one group to the other. The motor thus has the same power as a two-cylinder double-acting engine. The arrangement adopted offers numerous advantages, and permits especially of suppressing the shocks at the joints of the connecting rods that occur in double-acting engines at the time of the change of direction of the piston; of doing away with piston-rod stuffing-boxes, which it is often difficult to keep tight, and which absorb a certain amount of work in friction; of removing and putting in place a connecting rod and its piston without having to dismount a cylinder bottom.

The space available for a motor under the seat of a carriage is sufficient widthwise, but not lengthwise; and so the motor must

Compressed Air in Europe

occupy more space in the former than in the latter direction. Now, two double-acting cylinders of the same bore, placed either longitudinally or vertically, always take up more space than the single-acting four-cylinder arrangement adopted; and from this fact, it has been possible to have a greater available space for occupancy by the reservoirs of compressed air.

The distribution is effected by means of cams and valves. The opening of the latter takes place very rapidly. Their closing, on the contrary, occurs gradually, and is hastened or retarded through the shifting of the reversing lever, according to the admission that is desired. The minimum admission employed is 10 per cent., but this may be increased to 60 per cent. for starting. The exhaust and the compression are fixed, and have a duration of 20 per cent. of the stroke of the pistons.

There is no special cut-off of fluid between the expander and the cylinder admission valves. These latter open wide for all admissions between 10 and 60 per cent. of the forward and backward running of the engine.

The burners, which are three in number, are arranged beneath the worms in an iron plate jacket 10.75 inches in diameter and 12 inches in height, surmounted by a chimney which leads the gases of combustion to the top of the roof of the vehicle. The burners are supplied by a gasoline reservoir of a capacity of about ten quarts in which an air pressure of from 45 to 70 pounds to the square inch is created. The pipe that leads the gasoline to the burners may be partially closed by a screw plug. Through such arrangements, it is possible for the driver of the wagon to proportion the intensity of the heating to the output of air, so as to obtain a temperature that is always sensibly the same.

The quantity of gasoline consumed by the burners is about 15 ounces per hour of running; but this might easily be increased if it were found that the operation of the motor became thereby more economical.

The motor rests upon the floor of the carriage, beneath the seat occupied by the driver, who can thus examine it while it is running. Its rotary velocity for a speed of five miles an hour made by the vehicle is 200 revolutions per minute. The transmission is effected by means of chains of the "Varietur" system, which connect two sprockets, keyed at the extremities of the driving-shaft, with two toothed wheels of six times larger diameter fixed through bolts to the spokes of the hind wheels. The power of the motor, upon the crank-shaft, is 20 horse at a velocity of 300 revolutions, and at a pressure of 285 pounds.

The differential consists of two friction-cones fixed near the

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extremities of the driving-shaft and actuated by the steering apparatus. The control of these cones is such that, in a turning about, the adhesion of the one that is situated at the side of the internal wheel diminishes in such a way as to permit of a certain amount of sliding of the cone in its socket, and, consequently, of a retardation in the revolution of the corresponding wheel; while the adhesion of the cone situated at the side of the wheel that is to traverse the wide radius increases, so that no sliding in its socket can occur, despite the greater resistance of the wheel that is moving ahead.

The pivoting can thus be effected upon a driving wheel that is rendered absolutely immovable, from the view-point of revolution, and, consequently, in a circle having as a radius the distance of such wheel from the opposite wheel of the front axle, and that, too, in running forward as well as backward.

The steering is done by means of a hand wheel keyed upon the axis of an endless screw, which gears with a toothed wheel keyed upon the shaft of the reversing gearing situated beneath the vehicle. An indicator placed before the eyes of the driver exactly reproduces the changes in direction of the axis of the vehicle's path, and thus permits him to keep in a straight line.

The intermediate screw lengthens the maneuvering, but renders it sure, stable and gentle. Such an arrangement, however, offers advantages only for heavy vehicles designed for running always at a low speed.

Finally, let us say that the accumulators are placed longitudinally under the floor of the vehicle in two superposed rows, and are connected by easily accessible couplings placed in the rear. Movable panels permit of an inspection and of a tightening of the joints and couplings.

The motor and vehicle as a whole are well elaborated and denote upon the part of the manufacturers the possession of real ingenuity and a complete knowledge of the question with which they had to deal.

AN ENGLISH RACING MACHINE

According to the London *Daily Mail*, a committee has been organized among the members of the Automobile Club of Great Britain for the construction of a purely British racing machine. It is intended to enter this machine in the Paris races to be held in connection with the International Exposition of 1900.

A Front-driven—Front-steered Automobile

MOST automobiles are driven from the rear axle; they are *pushed*, in other words. Experience has shown that in pushing a vehicle, more effort is expended than in pulling it. A man can readily roll a four-wheeled carriage out of a stable with a slight pull upon the shafts; but in pushing it out, considerably more work is performed. Engineers have proven that the resultant of the forces applied in pushing a vehicle tends to press the front wheels on the ground; when the road is muddy,

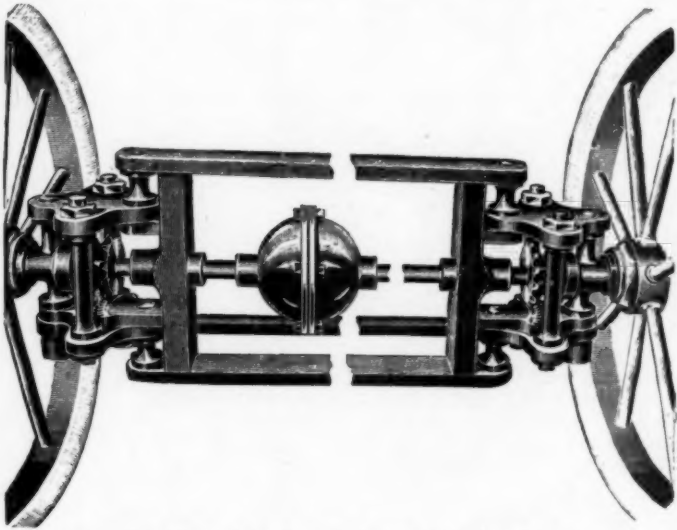


Fig. 1. Perspective View of the Fore-Carriage with Driving and Steering Gear

the wheels are embedded. If, on the other hand, the vehicle be pulled, the forces are applied only in a horizontal direction, and the amount of work performed is frequently 20% less than in the first case.

Experience has furthermore demonstrated that a carriage which is pulled is more easily steered than a carriage which is pushed. When the fore-carriage both drives and steers, the

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entire carriage immediately responds to the touch of the *chauffeur's* hand on the lever or wheel, the rear wheels naturally following in the track of the front wheels. But when the motive power is otherwise applied, the rear wheels do not begin to turn in the direction desired before the front wheels have, to a certain extent, been forced into the ground. It therefore follows that on muddy or sandy roads, if the front wheels be not sufficiently wedged in the ground, the rear wheels will not pursue the direction desired. The "waltzing" of automobiles—if it can be so

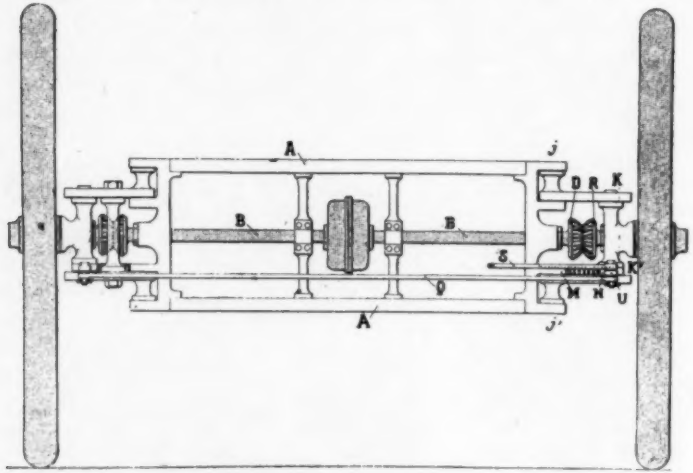


Fig. 2. Elevation of the Fore-Carriage. *AA*, Carriage-Frame *BB*, Motor-Shaft Carrying the Differential. *D*, Hemispherical Gear on the End of the Motor-Shaft. *R*, Hemispherical Gears on the Spindle. *KK'*, Bracket in which the Wheels are held and turning about the Pivot *jj'*. *MN*, Guiding Segment Gears. *U*, Steering Rod. *S*, Steering Lever. *Q*, Bar connecting the Two Steering Rods.

termed—is caused always by the inability of the fore-carriage to extricate the vehicle from its position. The proof of this is found in the only remedy known in such cases—by suddenly swinging the steering wheels into a position in which they will oppose the movement begun by the rear wheels.

Finally, experience has still further shown, that when the motor is mounted on the rear carriage the front wheels cannot be swung beyond a small angle (25° , approximately); for otherwise the vehicle could not be started, since the fore-carriage would block the rear carriage. On the road, the vehicle might even be

A Front-driven—Front-steered Automobile

overturned. The rear driven carriage can be steered out of a line of vehicles only when there is a clear road of several yards between it and the preceding carriage; it cannot be turned about on a straight road except by a succession of rearward and forward propulsions, or "backing and filling," as it were. The *avant-train moteur*, in which the engine is mounted on the fore-carriage, can be started even though the front wheels be almost at right angles with the rest of the carriage. Exceedingly short turns can be made.

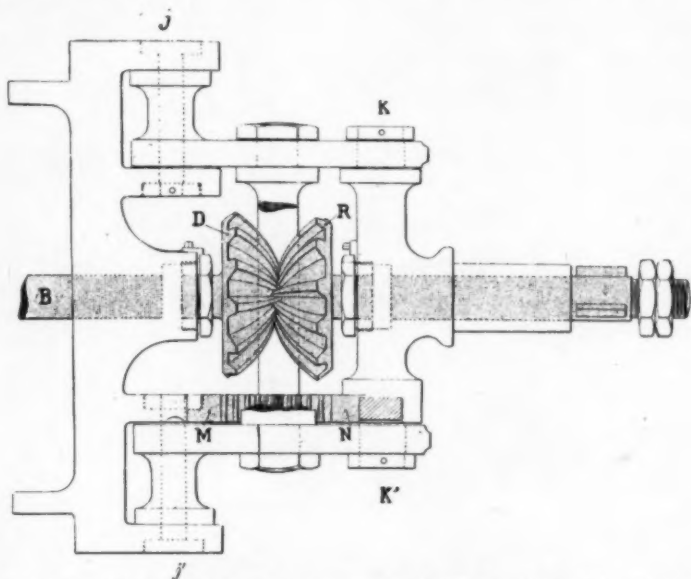


Fig. 3. Detail View of the Gears. *B*, Motor-Shaft carrying the Gear *D*. *R*, Gear carried by the Spindle. *M* and *N*, Guiding Segment-Gears. *KK'*, Pivoted Mounting of the Spindle. *jj'*, Pivots for permitting the Swinging of the Wheel relatively to the Motor-Shaft.

The superiority of the pulled to the pushed carriage being admitted, the question naturally arises: Why do not our automobile makers mount their motors on the fore-carriage? The answer is found in the mechanical difficulties which have hitherto not been overcome.

On a *priori* grounds it might be inferred that the problem could be most simply solved by reversing the functions of the front and rear wheels, or, in other words, by turning the carriage about and converting the rear driving wheels into front wheels,

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and the front or steering wheels into rear wheels. But it has been found in automobiles constructed on this principle that there is no more untrustworthy steering-gear, for speeds over 12 miles per hour, than that which is actuated from the rear wheels. To ride in such a vehicle at a speed of 24 miles per hour is suicidal.

The problem which confronted the inventor was, therefore, the construction of a carriage which would be both driven and steered from the front axle.

If there be but a single front wheel, the entire mechanism must perforce be mounted on that wheel. The difficulty of steering so heavy a wheel and the complexity of the construction are obstacles which are well-nigh insurmountable.

If the vehicle be a four wheeler, the two front wheels can be

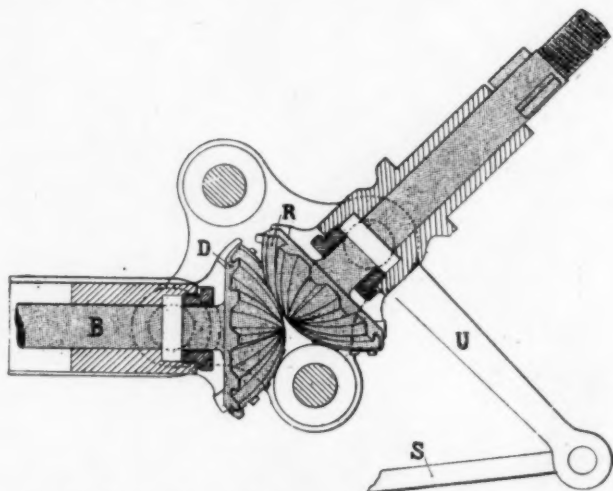


Fig. 4. Spindle-Controlling Mechanism *B*, the Motor-Shaft. *D*, Gear carried by the Shaft. *R*, Gear carried by the Spindle. *U*, Steering Rod for the Right Wheel. *S*, Steering Lever.

mounted on a rigid, centrally-pivoted axle. By an arrangement of gears, the power developed by the motor could be transmitted to the wheels in any position assumed by the front axle with respect to the carriage. But this method of steering by means of front wheels mounted on a pivoted front axle (as in the ordinary horse-drawn vehicle) has been criticized with some show of reason. It is argued that with fairly high speeds this method of steering is dangerous, because in order to turn ever so little to the

A Front-driven—Front-steered Automobile

right or to the left, the axle must be turned through a large angle, and in order to make a short turn, though it be comparatively slight, one of the wheels must be swung almost under the carriage, thereby considerably reducing the hold of the carriage on the ground. Finally, the system has the defect of being applicable only to high-built carriages, since sufficient room must be left for the front wheels to pass beneath the body.

The problem therefore narrows down to a carriage which is to be driven and steered from the fore-carriage and in which the front wheels are mounted on the divided axle usually met with in automobiles.

At first blush it seems an impossibility to transmit the movement of a rotating shaft to two wheels mounted at the ends of

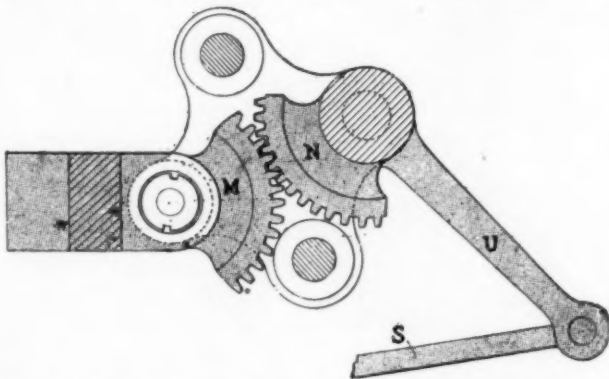


Fig. 5. The Guiding Segment-Gears. *M*, *N*, Safety Gear for guiding the Hemispherical Gears. *U*, Steering-Rod. *S*, Steering Lever.

the shaft, when these wheels, in order to steer the vehicle, will rarely be in a straight line with the shaft and will be constantly turned in ever-changing directions.

We shall see how, by a simple and novel arrangement of gears, an inventor has succeeded in solving this difficult problem. The system of this inventor is illustrated in the accompanying perspective and diagrammatic views, the casing within which the gearing is contained being removed.

In order that the driving-shaft of a motor may actuate a spindle with which it is not in alignment, but with which it forms a definite angle, bevel-gears must be employed. If the wheels were constantly turned in the same direction, if that be possible, the problem would have been solved long ago. But the wheels

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are ever changing their course, and the spindle forms an infinite number of angles with the driving-shaft of the motor. In order that steering-wheels could form any desired angle, a new form of gearing was evidently needed. The requirement was met by the spherical gear.

The driving-shaft of the motor, carrying the differential, is provided with a hemispherical gear at each of its ends, which is cut with tapering teeth. On each end of the spindle, opposite the wheel, a similar hemispherical gear is carried, which meshes with that of the driving-shaft of the motor.

The operation of these special gears is particularly effective, because when front and rear wheels are in alignment (as happens most frequently) there is no sliding friction between the gears of the driving shaft and the spindle, since under these conditions there is only an interlocking of the ends of the driving shaft and of the spindle. As the steering-angle increases, the thicker and stronger portions of the gears will be brought into engagement with one another; their resistance increases in proportion with the work which they have to transmit.

But a serious obstacle arises. The teeth of the spherical gears may have been originally badly cut or may have been worn away by constant use. The gears might then slide upon each other; and hence the jointing and pivots may bind.

The inventor has ingeniously and simply overcome the obstacle, by placing beneath the spherical gears two segment gears *M* and *N* which act as guides. The segment gear *M* is rigid; it is always parallel to the end of the driving shaft. The segment-gear *N* is movable; it turns with the wheel, but is always parallel to the end of the spindle.

Figs. 4 and 5 show clearly the relative positions of the two sets of gears. The manner in which the hemispherical gears adapt themselves to the steering angle is so plainly indicated that a verbal explanation is unnecessary.

Besides the advantages mentioned previously, this construction has other merits, among which may be mentioned its simplicity; the great strength of the spherical gears; and the total lack of all complicated mechanism. When the carriage is running in a straight line and the steering-angle is 0° , the gears engage each other at the ends. Power is transmitted with a minimum loss. The parts can all be inclosed in a casing, whereby they will be protected from dust and mud.

L. BAUDRY DE SAUNIER.

An Automatic Starting Gear for Hydrocarbon Motors

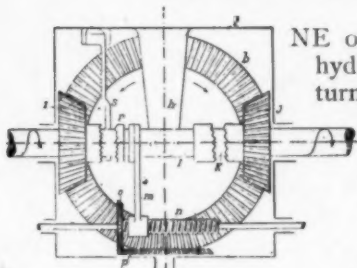


Fig. 1

NE of the greatest objections to the hydrocarbon motor is the necessity of turning a crank-wheel in order to set the parts in motion. The objection has been overcome in an ingenious invention, illustrated in the annexed engravings, Fig. 1 being a front elevation, Fig. 2 a side elevation, Fig. 3 a plan view, Fig. 4 an end view of a spring-casing, and Figs. 5 and

6 detail views of parts which will be described further on.

The apparatus comprises essentially a box or barrel *a* (Figs. 2 to 4), carrying a bevel-gear *b*. Within the barrel a spirally-coiled spring *C* is arranged, one of the ends of which is secured to a lug *d*, integrally formed with the inner wall of the barrel *a*, and the other end of which is secured to a lug *e*, on a shaft *f*, held in position by two supports *g*, *h*.

When it is desired to wind up the spring, the barrel is turned in the direction of the arrow *L*; when it is desired to unwind the spring or reduce its tension, the barrel is turned in the opposite direction, or in the direction of the arrow *B*.

The bevel-gear *b* of the barrel (Figs. 1 to 6) meshes with two bevel-pinions *i*, *j*, loosely mounted on the shaft *K*, directly controlled by the motor. These bevel-pinions each carry a clutch-member which can be thrown into engagement with a corresponding clutch-member on the sleeve *t*. The sleeve can be shifted longitudinally along the shaft *K*. By means of a fork *m*, this coupling-sleeve *t* is automatically shifted along the shaft.

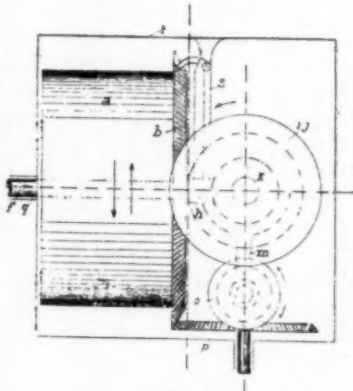


Fig. 2

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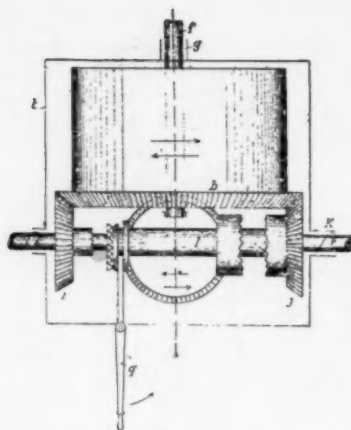


Fig. 3

The fork is operated by an endless screw n' , which is rotated by means of bevel-gears o and p , connected with the bevel-gear b of the barrel a . As the screw turns, the fork m is shifted.

In winding up the spring, the sleeve t is thrown over into engagement with the clutch-member on the bevel-pinion j ; and the shaft K turning in the direction of the arrow, communicates its motion to the barrel a . The barrel turns the endless screw m through the medium of the two bevel-gears o and p ; and the fork m moves toward the left, sliding leftward of the sleeve t

until it abuts against a shoulder, engages the sleeve, and throws the parts out of gear.

The movement of the fork is so regulated by the relative sizes of the gears and the pitch of the endless screw, that, when once the spring is wound, the parts are automatically disconnected.

The energy of the coiled spring is applied in starting the motor in the following manner:

By means of a lever q (Fig. 3) or pedal, the sleeve t is thrown over into engagement with the pinion i (Fig. 5). The flange r , on the end of the sleeve, then engages the arm of the detent S , which prevents the casing from turning in the opposite direction, by engaging the teeth of the bevel-gear b , as shown in Fig. 2.

When the barrel turns in a direction opposite to that followed in winding the spring, the direction of motion of the endless screw n is likewise reversed. The fork m is then shifted to the right (Fig. 5) until it engages the shoulder on the sleeve t , thereby forcing the sleeve into engagement with the pinion j (Fig. 6). When the sleeve is thus moved, the detent S falls away from the bevel-gear b ; and the motor-shaft K starts the bar-

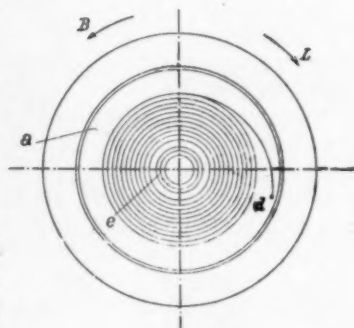


Fig. 4

Starting Gear for Hydrocarbon Motors

rel as explained above. The apparatus when once wound up, automatically, the parts are automatically disengaged and are ready to begin their operation anew. The entire mechanism is inclosed in a casing.

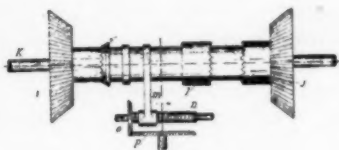


Fig. 5

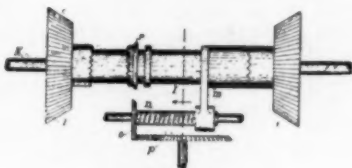


Fig. 6

Gaillardet's Speed-changing Gear

WE illustrate herewith a speed-changing gear devised by M. Gaillardet for use upon light motor carriages. The apparatus comprises a differential gear, a gearing for obtaining two speeds at will, an automatic friction clutch, an

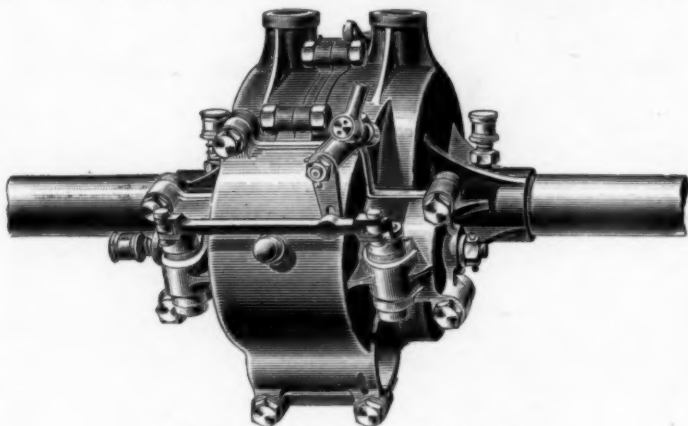


Fig. 1. Gaillardet's Speed-changing Gear.
(External View.)

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automatic brake for controlling the backward and forward running of the vehicle, and a chain-wheel with ratchet.

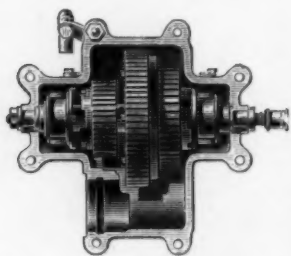


Fig. 2. Lower case, containing the speed-changing gearing, the clutch and the wheel that controls the motive pinion.

The entire mechanism is of cemented steel, refined and tempered. It is inclosed in a cast-steel case and operates in a bath of oil.

In addition to the mechanism, the complete apparatus com-

The advantages of this system are as follows: (1) It permits of throwing the motor out of gear; (2) the change from a low to a high speed, or inversely, during the running of the vehicle, is effected without any shock; (3) the chain is rendered immovable while the motor is in operation; (4) axles connected with the differential gear through joints assure the transmission of motion without resistance even though bearings are out of order or the axles are bent.

The axles are .95 of an inch in diameter and .88 of an inch at the collar.

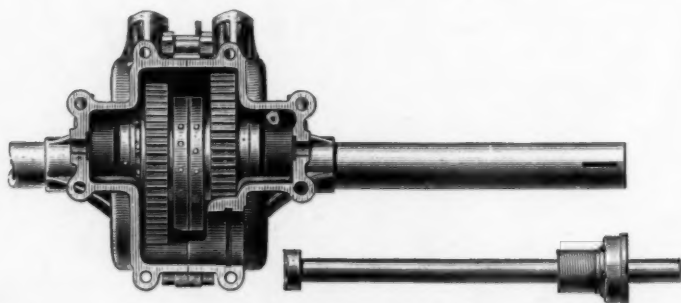


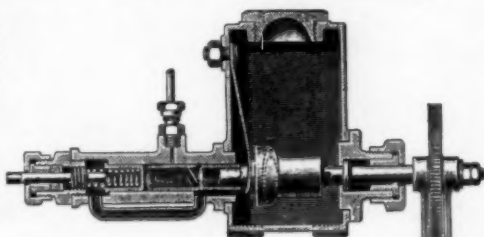
Fig. 3. Section showing the wheels that control the change of speed, the chain wheel and the brakes.

prises the hubs and the ball-bearings, that is to say, with the exception of the wheels, all the elements of a motor hind-carriage for a motorcycle or a voiturette.

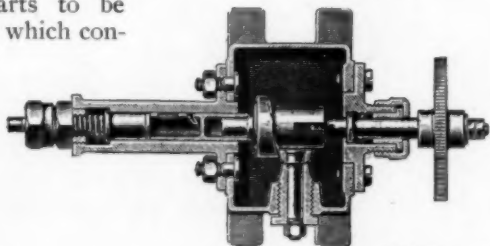
The Serpollet Lubricator

SO numerous are the parts to be lubricated in an automobile, that for the sake of simplicity and convenience, it is customary to employ a single oil-feeding device by which the moving parts of the driving mechanism are automatically oiled. Among the many devices of this type may be mentioned the Serpollet lubricator, noteworthy for the ingenious, simple means provided for feeding the lubricant.

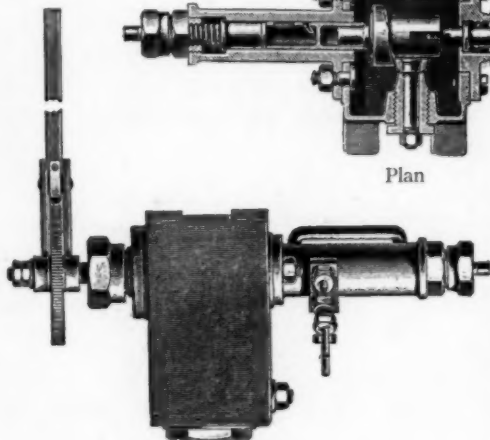
The Serpollet lubricator is essentially a pump which forces oil from a reservoir into passages leading to the parts to be oiled, and which con-



Cross Section



Plan



Side Elevation

tains no easily-damaged, delicate valves. The oil is constantly returned to the pump and used anew.

The lubricator consists of an oil-reservoir, through the lower part of which passes a shaft driven by the motor.

Within the reservoir this shaft carries a piston, which, besides the rotary movement of the shaft, has also a reciprocating motion

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imparted by a cam spring-pressed on a roller rotating about a fixed axis. The piston at one end is provided with a hollow, perforated cylinder having a simultaneous rotary and reciprocating motion within another cylinder constituting the body of the pump, from which the various oil-ducts lead.

During the period of admission, that is, when the piston enters the cylinder, at the same time making a semi-revolution, the admission orifice of the piston-slide communicates with the reservoir; the return orifice at this period corresponds with the entire wall of the pump-body.

During the period in which the oil returns, that is, when the piston is on the return stroke and is making the second semi-revolution, the admission-opening is closed, while the return opening passes successively before the orifices of the return passages, discharging into them the oil pumped during the previous stroke.

The oil can be returned at a pressure varying between 2 and 50 pounds, by adjusting the tension of a spring pressing on the piston.

OBERAMMERGAU'S INNOVATION

The large iron theatre now under construction at Oberammergau for next year's Passion Play, is nearly finished. The stage will be in the open air. The auditorium will be 143 feet long and will accommodate 4,000 spectators. Two further improvements are also announced. There will be an office established for the purpose of assigning visitors suitable lodgings, and the tedious two-hours' drive to the village from the railway will be abolished, as well-equipped electric motor carriages will take visitors from Oberau in half an hour. Needless to say, the villagers do not like these departures. They say it will detract from the devotional attitude which all visitors to the Passionspiel are supposed to assume. Apart from that, it is bound to interfere with the decennial prosperity of the village stage-driver and other rustic Jehus.

The Present Uses of Aluminium

By Leon Auscher

SOME recent discussions have attracted the attention of the public upon a new score to the use of aluminium. The commendations of its manifold advantages by some and the criticisms of its numerous shortcomings by others are certainly making of it at the present moment the most discussed of metals; and it might be supposed that the aluminium industry, bandied by such appreciations of opposite nature, was languishing and wavering, did not the increasing figures of production step in to prove a rapid development of this new branch of metallurgy.

Although the very marked increase in the production permits, on the one hand, of exactly answering the requirements of the moment, the number of new applications, on the other, continues increasing; and a new use of aluminium is rendered practical nearly every day.

Is this as much as to say that the present discussions are destined to be left out of consideration, and that we must deduct therefrom only what is favorable to this metal? Such is not the opinion of those who are endeavoring to derive profit, in favor of aluminium, from all the experiments made on both sides.

From these discussions, on the contrary, is evolved a moral, and that is that aluminium, a new metal, but slightly known primitively as regards methods of use, imperfectly refined, and mixed in improper proportions with other metals, began by being regarded by nearly everybody as the metal of all-work. It did not suffice that it was the lightest and one of the least oxidizable of metals, but it was seen fit to require of it all the other qualities of all the other metals to their highest degree. It was asked to be the most resistant to flexion and torsion, the most ductile, the most unalterable, etc. And, every time a check in detail was experienced in the accomplishment of this vast programme of research, a hue and cry arose against aluminium. The fact was not taken into consideration that it was not the metal that was to blame, but rather the injudicious employment of it, or, more plainly speaking, the wrong manner of using it.

Thus, it appears from an interesting note from M. Ditte to the Academy of Sciences (March 27, 1899), that the aluminium plates employed in Madagascar for canteens and platters, or as panel-material for the Lefèvre carriages, offered poor

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resistance to the various ordeals of so hard a campaign. A certain number of the facts that were made known by M. Ditte are to be found in a note from M. Moissan, of the 10th of last April. The most remarkable of these relates to the proportion of impurities found in mixtures of aluminium from 1893 to 1897. M. Moissan calls our attention to the fact that the progress made in the manufacture has caused aluminium to pass from an average of 93 to 99 per cent. of pure metal, and has eliminated such important impurities as sodium, carbon, iron and silicium.

The 96 per cent. alloy of aluminium, however, seems to be the metal that is most widely employed at the present time under the most diverse forms. Moreover, as this metal is produced in bars and plates and in angle and T-form, it lends itself to all the processes of construction that require extreme lightness combined with great resistance.

The every-day applications of aluminium are manifold. The following are the principal ones:

Hardware—Under almost all its forms.

Telegraphy—Telephones, wires and cables.

Army—Field and mountain gun-carriages, armor-plate, ammunition-chests, cartridge-shells, sabre-scabbards, lance-staffs, helmets, breast-plates, stirrups, and encampment and equipment material.

Cycling—All detached pieces, fellies, frames, etc.

Lighting—Tubes for coal gas and acetylene.

Music—Wind instruments.

Surgery—All kinds of instruments.

Kitchens—Plates, knives, forks and kitchen utensils generally.

Watch-making—Watch-cases.

Optics—Opera-glasses, field-glasses, telescopes, etc.

Fancy Articles—Confectionery boxes, bread-baskets, hand-mirrors, ash-pans, writing-table articles, etc.

Finally, among the new applications, it is pertinent to mention the uses created by the very prosperous, and essentially French, automobile industry.

For the accessory pieces of the frames, as well as for the principal parts of the carriage-work, a large proportion of aluminium, and especially of aluminium alloys, is used. Up to a certain point, these alloys permit of the choice of a metal possessing any such qualities as the use to which it is to be put may require. *Apropos* of this, it is impossible to omit a mention of the name

The Present Uses of Aluminium

of M. Henry Partin, a specialist in aluminium, if there ever was one, and who presented French industry with *partinium*—an alloy of aluminium (density 2.56) and tungsten (density 18), which, with the lightness of aluminium, combines a resistance that increases with the proportions of the alloyed metal.

Melted in sand, its density is 2.89. Its resistance to traction is from 17,000 to 24,000 pounds to the square inch, and its elongation is from 12 to 6 per cent., according to the proportions of the alloyed metals. When rolled, its density is 3.09, its resistance to traction from 46,000 to 53,000 pounds to the square inch, and its elongation from 8 to 6 per cent. Partinium is employed for making those casings of well-known aspect that inclose the motors of tricycles, and also the large casings employed on the De Dion 30 or 40 horse-power steam-carriages.

For all such uses, bronze and copper have, without any inconvenience, been replaced by a metal which weighs half less and possesses a third greater resistance. Let us add that the net cost of the raw material for such pieces is the same, whether it be bronze or partinium, and that the net cost of the finished piece is less for the latter, since the metal is more easily worked.

Finally, the rolled metal has been employed for a year past in carriage-work, for the bodies of automobiles. It lends itself to all shapes and is capable of receiving metallic mouldings. A body of this kind, mounted upon a frame of angle pieces, with a plate lining, constitutes a metallic combination that, with equal resistance, weighs from 50 to 60 per cent. less than wood, and that, provided certain precautions be employed, may receive the same coats of paint as a fancy carriage. Here again the industry has made gigantic strides.

The first partinium carriage-body dates back to the Paris-Bordeaux race of 1898. At present, all *chauffeurs* have adopted this important improvement in automobile carriagework; racers, because lightness plays an important part in the results of a contest; and tourists, because it is better to substitute passengers or useful baggage for from 200 to 450 pounds of dead weight.

Finally, in the train of some experiments on crushing, in which this metal withstood a pressure of 54,600 pounds to the square inch without distortion, the manufacture of houses that can be taken apart and transported has been undertaken.

It will be seen that aluminium, in all its forms, is being further and further employed; and it will be still more extensively used when the price of it, which is already reasonable, shall permit of new industrial applications being thought of.

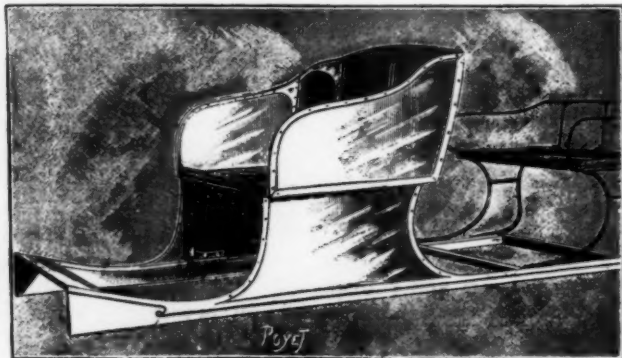
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The following figures show the decreasing prices of the metal from the time of the discovery of the first processes of manufacture by Sainte-Claire Deville:

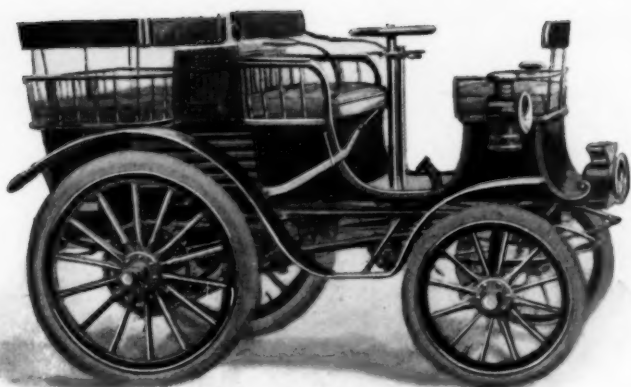
1854	\$270.00 per pound.
1856	135.00 " "
1859	36.00 " "
1864	9.00 " "
1889	2.25 " "
1891	1.80 " "
1892	1.09 " "
189445 " "
189636 " "
189932 " "

The consumption for the last three years in France has been about 600 tons per annum—a figure which it seems ought to be doubled in 1899.

If we consider that bauxite, an argillaceous ore of aluminium, is one of the most common ores of France, and that the metal is being extracted from it under more economical conditions from day to day, we may believe that the above decreasing scale is still far from its final limit. Although, then, we are perhaps wrong in emphatically denominating aluminium as *the* metal of the future, it cannot be denied that it is, to the highest degree, a metal *with* a future. Its fate will depend in either case upon the judicious use that will be made of it, and upon the chemical composition of its alloys.



Partinium Body for an Automobile



The Gobron and Brillié Automobiles

By G. Chauveau

THE Gobron and Brillié automobiles, which, comparatively speaking, have but recently made their appearance, attracted the attention of specialists at the very outset by reason of their very interesting peculiarities.

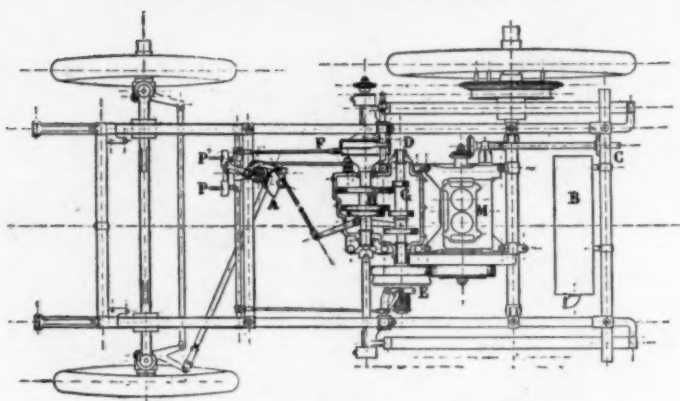
Among the different types of carriages brought out by the above-named manufacturers may be mentioned an elegant wagonet, which is actuated by a six horse-power motor, and which we illustrate in perspective in Fig. 1, and in side elevation and plan in Figs. 2 and 3.

This automobile is provided with a frame of steel tubes to which are brazed cast-steel couplings. The longitudinal members of this frame have the form of trussed girders, that assure absolute rigidity to the whole and that rest, through springs, upon the front steering and hind driving axles.

The steering is done through a divided axle maneuvered in a very peculiar manner, which we shall describe further along.

The motor *M* (Figs. 3 and 4), through toothed wheels, actuates an intermediate shaft, *G*, by means of a cone-clutch, *E*. This

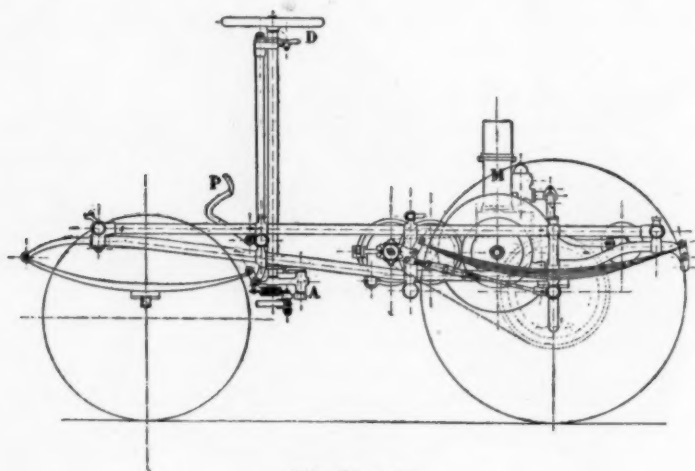
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Plan

shaft carries a train of three pinions which slide longitudinally and are capable of being thrown into engagement with three wheels fixed to the box of the differential gear, *D*, so as to give three multiplications. A complementary pinion permits of reversing the motion of the carriage.

The differential shaft, *H*, at its extremities, controls the hind wheels through the intermedium of sprockets, chains and toothed wheels.



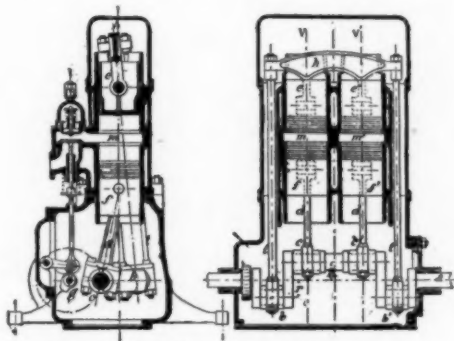
Side Elevation

The Gobron and Brillie' Automobiles

The gearings are enclosed in a tight aluminum casing.

The changes of speed are effected through a lever mounted upon a bar near the steering-shaft. Of the two pedals P and P' , one actuates a disengaging gear, and the other a band-brake, F , mounted upon the differential as well as upon the disengaging gear. The starting is effected at the rear through a winch at C .

The motor is so combined as to reduce the vibrations to a minimum through an equilibrium as perfect as possible of the parts in motion. It consists of two vertical cylinders placed side by side and open at their two extremities; and is of the four cycle type. The two lower pistons, $f f'$, through their connecting-rods, $d d'$, actuate the central crank of a three-throw crank-shaft. The cylinder bottoms are replaced by two other pistons, $e e'$, which move in a direction contrary to that of the first. These



Sections of the Motor

pistons are connected through a cross-head, h , with the two connecting-rods, $t t'$, that act upon the lateral cranks, $b b'$, which are both set at an angle of 180° with respect to $c c'$.

The lower pistons have a stroke slightly longer than that of the upper ones, so as to compensate, by their difference in velocity, for the difference of the mass, and to obtain a perfect equilibrium.

The inside diameter of the cylinders is 3.2 inches; the stroke of the lower pistons is 3.2 inches, and, of the upper, 2.4; and the number of revolutions is 900.

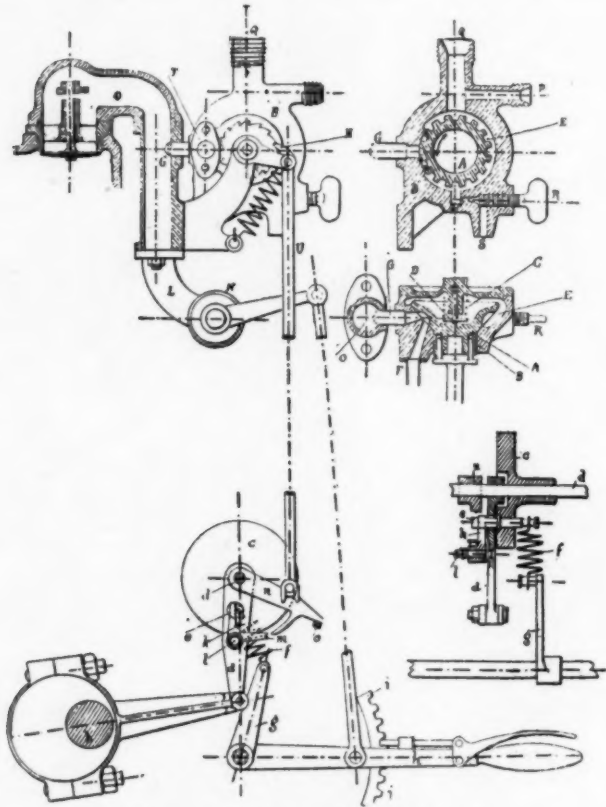
The distribution is effected through vertical valves placed in boxes at the side of the cylinders. The admission is automatic. The exhaust-valves are controlled by rods lifted by cams placed upon a shaft parallel with the driving shaft. This cam-shaft, which is controlled by gearings, revolves with a velocity twice

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less than that of the driving-shaft. Finally, this entire mechanism is enclosed in a tight casing.

The electric ignition is effected through batteries, accumulators or induction coils. The cooling is done through a circulation of water, with a reservoir, pump and radiator.

As for the regulation, that is obtained through a suppression of the explosive mixture by modifying the supply of gasoline that enters. To this effect, the carbureter (Figs. 5 and 6) consists of a box, *E*, similar to that of a stop-cock, the key, *A*, of which is provided at its circumference with a series of cells. *E* is full of gasoline that enters at *P*. At a certain point of the box there debouch two ajutages, *r* and *G*, the former of which communi-

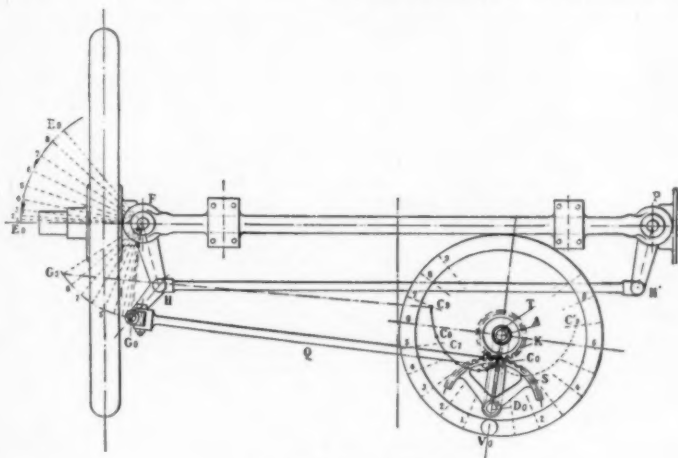


Elevation of Carburetor and Regulator

The Gobron and Brillie' Automobiles

cates with the exterior, and the latter with a suction-conduit that extends to the admission-valves, *o*. The key *A* is moved by a ratchet-wheel controlled by an eccentric secured to the driving-shaft, between which and the distributor is interposed a regulator which we shall presently describe. In the revolution of the key, a cell full of gasoline presents itself in front of *r* and *G* at the moment at which an admission occurs; and the air drawn in through *r* vaporizes the gasoline which is carried along in the current of air.

It suffices to arrest the action of the eccentric upon the ratchet in order that (the key remaining stationary) no formation of



Steering Apparatus

explosive mixture may take place. To effect this is the office of the regulator (Figs. 7 and 8) just mentioned.

The eccentric, which through the intermedium of a system of levers, *d n*, a rod, *u*, and a click, controls the ratchet of the gasoline distributor, imparts an oscillatory motion to a mass *C*, held by the lever *d* through a tappet which passes with a certain amount of play into the said lever. Upon this lever *d* is pivoted a detent, *k*, one branch of which is held by a spring, *f*, against the tappet, while the other is provided with a notch, *m*, with which engages a finger projecting from the lever *n*. When an increase in the normal velocity occurs, the mass *C* receives an impulsion, the detent *k* oscillates and releases the finger of the lever *n*, and the consequence is a suppression of the motion of the ratchet.

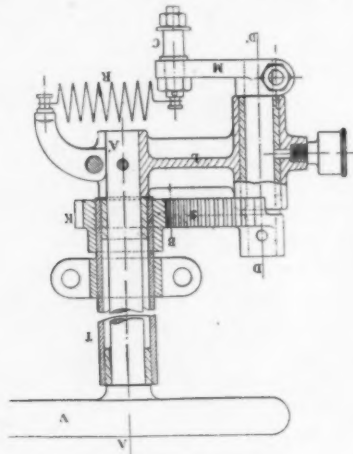
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A hand-lever, *j*, permits of varying at will the tension of the spring, and, consequently, the velocity, which may vary from 300 to 1,500 revolutions.

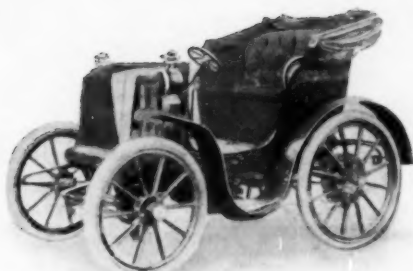
In the construction of the steering-apparatus, which is very peculiar, it has been the object of the manufacturers to obtain both safety and rapidity in turnings about. Speaking in a general manner, it may be said that safety is obtained by a great reduction, and rapidity by a feeble one. With the arrangement here adopted there is at once a great reduction in running in a straight line, and for slight deviations, and a feeble reduction for turning about. We have here, then, a variable reduction apparatus responding to the conditions indicated above.

To effect such a result, the steering hand-wheel, *V*, is so arranged as to carry along in its rotary motion a lever, *L*, which presents a vertical axis, *D*, upon which, through a bush, is mounted a toothed sector that rolls upon a stationary pinion, *K*. From such an arrangement it results that, during the rotary motion of the hand-wheel *V*, the stud *C*, jointly with the toothed sector *S*, describes an epicycloid. To the angular changes of position of the hand-wheel, marked 1, 2, 3, 8, 9, there therefore correspond positions *C*¹, *C*², *C*³, *C*⁸, *C*⁹ of the stud *C* that controls the rod *Q*.

It will be seen that the more the rotary motion of the hand wheel is prolonged, the greater will be the angular changes of position of the journals of the steering wheels.



Longitudinal Section



The Bravo Gasoline Motors

By Maurice Chérie

AMONG the interesting novelties of the latter part of the year just passed must be mentioned the gasoline automobiles built by the Bravo establishment recently installed at Clichy.

The carriage represented above offers certain peculiarities, the most interesting of which we purpose to pass in review.

Let us say at once, that through the judicious arrangement of its parts and the form of its absolutely rigid frame, it cannot fail to satisfy the requirements of all those who are looking for a strong, elegant and comfortable vehicle.

All the pieces that enter into its construction are of great strength and are so combined as to afford a very lengthy service without necessitating troublesome repairs. All the transmitting parts, reservoirs, etc., are almost entirely concealed in the carriage-work, so that the vehicle bears a remarkable stamp of elegance.

The motor is vertical, with two convergent cylinders, and the pistons drive the shaft through the intermedium of a single crank. All the parts in motion are enclosed in an absolutely tight casing. The connecting-rod bearings, which are very wide, are of cemented steel, refined and tempered. The bearings of the shafts, which are of phosphor-bronze, are also very wide and thus assure the motor an operation of long duration without any appreciable wear. Through an ingenious arrangement, a continuous circulation of oil takes place in the casing, and this renders the consumption of the lubricant insignificant, and necessitates no surveillance.

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The ignition is effected either through an electric spark or incandescence. With the sparking, an extremely simple device in which but a single cam is employed permits of obtaining all the velocities of the motor, say from 300 to 400 revolutions, through the simple maneuver of a button.

In the ignition by incandescence, a centrifugal governor provided with ball bearings acts upon the motor in such a way as to keep the exhaust-valves open during the change of speed. During this period, the admission-valve allows a small charge of fresh air to enter the cylinder, and the motion of the piston expels the products of combustion, the effect of which is to improve the work of the motor.

One very interesting point in the Bravo motors is the method

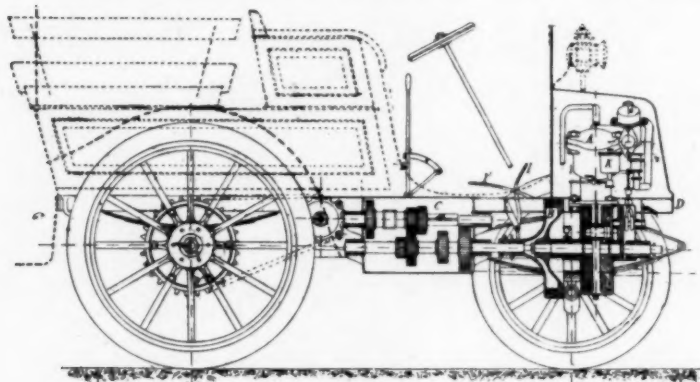


Fig. 1. Longitudinal Section

of starting them, this being done instantaneously by a single revolution of a winch.

The cooling is effected through a centrifugal pump set in motion by the fly-wheel of the motor. The tension of the pump's friction is regulated automatically through a spring.

The Bravo establishment has brought out types of motors of 5, 8, 10, 16 and 20 horse-power, which, according to requirements, may be mounted upon frames through couplings.

Fig. 1 represents a frame provided with an 8 horse-power motor with electric ignition. The motor, which is arranged in front, is put in connection with the speed-changing gear through a leather-faced cone-clutch. As may be seen from the figure, the gearings are enclosed in a casing, *C*, which receives also a reduction gearing, *r*, that reduces the velocity in the ratio of about

The Bravo Gasoline Motors

1 to 3. As the angular velocity of the gearings is thus relatively feeble with respect to that of the motor, it follows that the changes of speed are effected with the greatest facility, without noise, and in avoiding the frictions and shocks that are so prejudicial to the duration of the parts.

The reversal of motion is effected through the shifting of two bevel gearings, $p p'$, mounted upon the shaft of the differential gear M . For the purpose of avoiding the thrusts due to the changes of level of the frame in violent joltings, the differential shaft is divided into four parts (1, 2, 3, 4), the extreme junctions of which are made by universal joints.

The carriage-body is mounted upon the principal frame, D , while the motor and the mechanism are fixed upon the separate frame D' .

One interesting peculiarity of the Bravo motors consists in the dismountable steering-axle (Fig. 3) which is of a special system. The head of the tubular axle is formed of a vertical

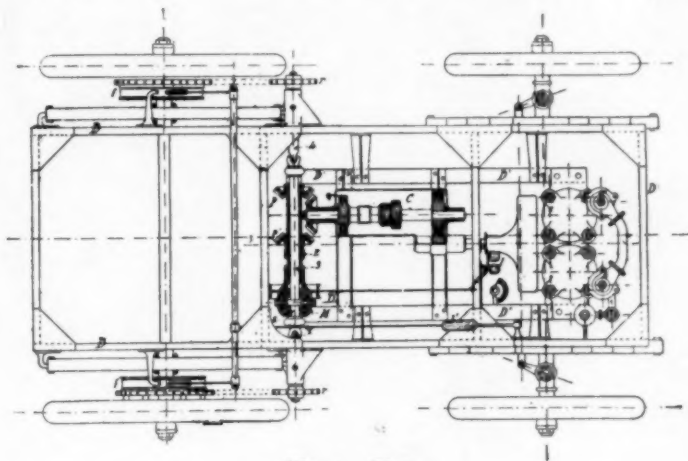


Fig. 2. Plan

socket, B , which receives an axis, A , upon which, through a socket-clutch, is mounted the journal-support, H , which is held simply by a nut, L . The weight supported by each journal is distributed over a horizontal row of balls that roll between two tempered steel plates. A large circular nut, R , that closes the ball-case permits of the regulation of the play in a perfect manner. The screw, V , prevents any loosening.

In this steering pivot, the pieces having a motion are entirely

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immersed in the oil with which the box *B* is filled at the time of the first mounting. The oil afterwards lasts indefinitely. This process of mounting renders it very easy to do the steering, which is effected through an inclined handwheel with a transmission through bevel gearings and rigid levers with a universal joint.

The safety apparatus comprise a band-brake mounted upon the differential gear and controlled by a pedal; and a hand-brake that acts upon the tires of the wheels. An electric interrupter permits of the instantaneous stoppage of the motor by throwing it out of gear without the driver having to change his position.

All the controlling parts are grouped in such a way as to render the driving of the vehicle very easy. The maneuvering levers are straight, without any latch or connecting-rod. All the points of oscillation are of tempered steel, thus considerably diminishing the play and wear of such pieces.

As may be seen, the carriages built by the Clichy establishment present many well elaborated peculiarities of detail that render them very resistant and cause them to run with great regularity.

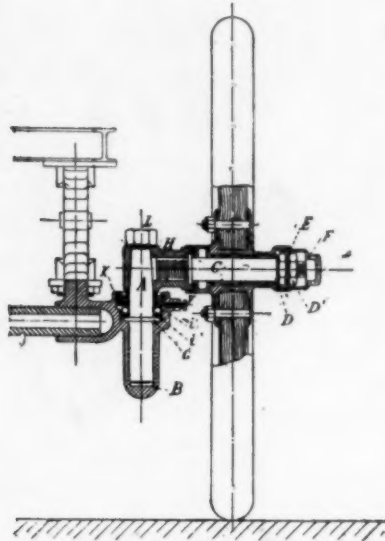
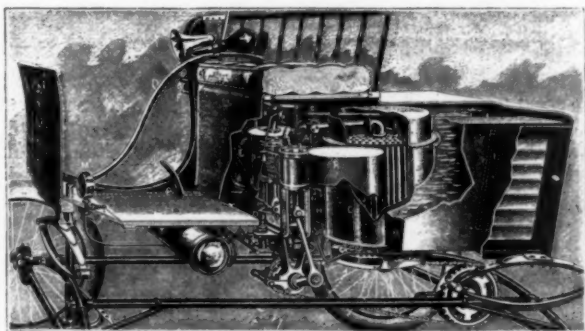


Fig. 3. Section of Steering Wheel and Axle

The Locomobile

SINCE the Locomobile was described in our January number, a number of modifications and improvements have been made in it. In view of the attention at present being devoted to steam automobiles generally, the following description and detail illustration of the latest may not be without interest at the eve of the spring trade opening.

The oil fuel is led from the fuel tank, where it is carried under 20 or 25 pounds air pressure through a vaporizing pipe, which passes through the boiler, and thence the vapor goes through a passage which may be closed by a regulator-valve to the burner. In front of the burner a special automatic petroleum supply regu-



Part Sectional View of Locomobile Showing Location of Engines and Boiler

lator is provided, by means of which as soon as the steam pressure in the boiler attains a certain degree the flame of the burners is automatically lowered, there being a by-pass of limited cross-section leading around the regulator valve which keeps the fire alight. So soon as the regulator valve acts to reduce the fire it also opens a large area of cold air entrance to the fire-box, which has the effect of instantly checking the steam production. This makes the action of the burner exceedingly prompt, and keeps the steam almost exactly at the regulator pressure in the boiler, no matter whether the carriage is traveling up-hill or coasting down-

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hill. The pump delivery is about constant; the regulator is set at about 150 pounds, and the safety valve at 160 pounds. No cylinder drainage cocks are used, so that the boiler feed is always about the same for, say, each ten miles run, and hence the whole regulation of the fire and water are thus automatically taken care of. The boiler carries 8 inches of water above the tube sheet, leaving 5 inches of steam space, but an inch or two either way in the water level makes no difference, the boiler acting perfectly down to 1 inch of water over the lower sheet. Thus the driver has nothing to do except to steer and handle the throttle valve. A glass gauge on the outside of the wagon body shows at a glance where the water level is. The burner gives an absolutely perfect noiseless combustion, the up-take discharge not having any odor, and being wholly invisible. The fire is also invisible, appearing through the fire-box peep-hole as a wavering, bluish haze when burning hard.

The transmission of the power from the engine crank-shaft is effected by a hard sprocket of twelve teeth on the engine-shaft, connected by a single light central-driving chain to a twenty-four tooth sprocket-wheel, on the compensating gear-box on the rear axle. The chain adjustment is obtained by a right and left threaded screw strut, jointed at one end to the yoke of the rear axle support which surrounds the compensating gear, and at the other end to the lower part of the engine frame, in about the plane of the crank-shaft. This permits the rise and fall of the engine and small chain-wheel sprocket without material change of chain length, and relieves the pneumatic tires of all weight not carried on springs.

Steering is controlled by a bar acting on the front wheels which are mounted on vertical pivots in the usual way. Three band brakes are provided; one controlled by a foot-pedal acting on the differential and one each, actuated by a hand lever, on the hubs of the rear wheels. The wheels are of the cycle type, shod with small pneumatic tires. It climbs any gradient, and can be got ready by an expert in less than five minutes, from five to ten minutes being required to get up to its fullest power.

The Automobile MAGAZINE

An *ILLUSTRATED* Monthly

VOL. I No. 5 NEW YORK FEBRUARY 1900 PRICE 25 CENTS

The AUTOMOBILE MAGAZINE is published monthly by the United States Industrial Publishing Company, at 31 State Street, New York. Cable Address: Induscode, New York. Subscription price, \$3.00 a year, or, in foreign countries within the Postal Union, \$4.00 (gold) in advance. Advertising rates may be had on application.

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Editorial Comment

THE PRESENT STATUS

AS a matter of historical record it will not be amiss to note the actual condition of the automobile industry in this country at the opening of this last year of the century. Our sense of moral responsibility to the community, which supports us by its subscriptions and its generous commendation and words of encouragement, impels us to set forth a few facts that might well be overlooked by the casual reader who scans the pages of the *AUTOMOBILE MAGAZINE* and admires the numerous pictures of motor vehicles, many of which have been thought of, some of which have been built and a few of which have been sold and are supposed to be in use. It may be true that the streets of Boston have been forsaken by the horse, as described by the "Listener" of the *Boston Transcript*, and reproduced elsewhere in our columns, but as far as the avenues of New York are concerned truth compels us to say that aside from the occasional cab or trap of the Electric Vehicle Company and the runabout of the Locomobile Company, to which the public has become somewhat accustomed, the appearance of a vehicle without a horse to draw it attracts a curious crowd with greater rapidity than a fire.

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The same conditions, more or less, prevail in Chicago, Philadelphia, and Washington, while in the smaller cities it is safe to say that the reading of eloquent predictions for the future of the automobile and the still more glowing prospectuses of companies organizing for the production of twenty or more vehicles per day, is the only evidence of the new industry which is destined to work such beneficent changes. In fact the literature of the automobile is at present more voluminous and picturesque by far than the manufacture. There are more publications on this subject, some appearing regularly and others "every little while," than there are factories in actual operation, prepared to furnish automobile vehicles with reasonable promptitude and at a fair price. As for the prospectuses of companies which have a limited amount of treasury stock for sale to the hopeful investor, it is to be regretted that the same amount of air, whether liquefied or compressed, which the promoters have made use of in the flotation of their shares, could not have been successfully employed to propel their imaginary vehicles.

Meanwhile even the reputable persons who are at the head of millionaire companies, and whose pictures adorn the pages of the trade papers, are singularly slow in perfecting their organization and turning out work. We hear that they are "rushed with orders" and that it is impossible for them to supply their demand, but is it not time that we should see some tangible results of this enormous production? Yankee ingenuity should surely devise some means to gratify the desires of those who are ready to sell their horses and adopt the automobile.

It must be confessed, and as far as we are concerned, with the keenest regret, that the present status of the automobile industry would be more correctly defined as the present hiatus. It cannot be denied that the majority of the manufacturing enterprises in this line are still enveloped in darkness and slowly groping towards the light. Instead of being "rushed with orders" and producing hundreds of vehicles weekly they are, in reality, either looking for capital or new patents or improvements in their present methods which shall insure greater economy and practicability in their product. The would-be *chauffeur* often stands aghast when he views for the first time the inner workings of the vehicle which he is asked to buy. Some of the clumsy and intricate affairs so far devised could better be described as traveling machine shops than as vehicles. Naturally the manufacturers of these interesting but complicated mechanisms are not in a hurry to turn out a large number, fearing with good reason that simpler and cheaper ones will soon be in

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the field. The manufacturer well knows that the ordinary man has little knowledge of machinery and less desire to be bothered with it.

A glance at the advertising pages of the *AUTOMOBILE MAGAZINE* shows the small number of American factories that are really in position to supply vehicles, in comparison with the many in Europe which are in successful operation. We are at present in the educational period of automobilism on this side of the Atlantic—everybody is intensely interested in the subject, everybody wishes to learn. The best tire, the best wheel, the best bearing, motor, steering device, battery—all these things are eagerly sought after by manufacturers and future users of the automobile. For this reason there is sure to be an attentive audience for all those who have new devices to offer, whether American or foreign, and while for the moment, we find much better material obtainable in Europe and consequently must devote to it greater space in the *MAGAZINE* than we should like to, there is little doubt that during the present year we shall witness such a step forward on the part of our inventors and manufacturers as will eventually place this country at the head of this industry, and in a position to sell automobile vehicles to all parts of the world, as is already the case with the bicycle.

THE COMING CONTEST

THE coming automobile contest for James Gordon Bennett's international challenge cup, the racing conditions for which were set forth in the January number of this magazine, is already widely engrossing the attention of automobile interests. Mr. Bennett has taken up the racing aspect of the automobile with the same enthusiasm—youthful enthusiasm, it might be said of one whose interest in sport is so perennially keen—that he originally gave to yachting contests. It seems singular that the racing possibilities of the great invention of mechanical locomotion should have had to wait for their development until the closing years of the century that witnessed its practical introduction. The invention that in less than a century has effected the most marvellous transformations in civilization—although it has given us the swiftest means of transportation, attended by the most exciting form of motion—has hardly been the subject of racing-contests until the perfection of the automobile emancipated the

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locomotive from the thralldom of the rail. This has brought the proverbial "iron horse"—in its contemporary form as a steed of steel—into the same popularity that has made the centaur-like combination of man and bicycle the rival of the horse in the world of sport. It has been a most extraordinary progression. First the animal organism putting forth its muscular energies in the development of high speed under the guidance of human intelligence and skill. Next, the lightest and most delicately adjusted form of motor-mechanism—the bicycle—impelled by the trained and specially developed muscular energy of man under the guidance of human intelligence and skill. And finally, human intelligence and skill sitting supreme in the guidance of a most complex and powerful mechanism impelled by its own motive power, the element of animal intelligence that was an essential factor in the first of these three forms here being combined with the human organism. In other words, we first have a highly developed natural mechanism actuated by organic energy responding to animal intelligence subordinate to human intelligence. In the second place we have a highly developed artificial instrument actuated by organic energy directly responsive to human intelligence. And in the third place we have a highly developed artificial instrument actuated by inorganic energy directly responsive to human intelligence. We thus at last have the locomotive given the freedom of the road—all the dynamic potentiality of the Transcontinental Express free to be exercised on the common highway! It is no wonder that the manifestation of this extraordinary power should appeal in the highest degree to the emotions that delight in contests where energy, speed and skill are involved in most exciting combinations. For what has just been characterized as the emancipation of the locomotive is in reality the transference of its subjection from the sure inevitable control of the rail of steel to that of the subtle band of the immaterial rail that exists solely in the human mind, where a momentary break in its continuity, a slight relaxation in the tension maintained by facile hand and perfectly balanced nerve, would bring disaster and destruction. All this means, of course, one of the highest forms of athletic contest possible to man.

While the utility of such contests may not be directly apparent—for the automobile is essentially a vehicle for the highway, and the highway is no place for racing, as a rule, but the world's common instrumentality of intercourse between communities and nations—nevertheless in the promotion of skill and courage that comes with such contests, and the development of inventive resources in consequence thereof, we inevitably have results of

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the greatest value to society at large, and civilization correspondingly profits thereby.

The American challengers for the contest, through the Automobile Club of America—Messrs. Winton and Riker and the third contestant—are thoroughly representative, and their entrance will be most encouraging for prospects of a successful issue. France is naturally the home of skilled and courageous *chauffeurs*, and it is notable that so many are eager to enter the contest that some of the best French racers may secure the coveted opportunity to enter only under the challenge of the Belgian club. The German and Austrian clubs have also sent in their challenges, and it is assured that the contest that is to mark the last year of the twentieth century will begin a famous series of international races most worthily.

TEMPORA MUTANTUR

The remarkable headway which has been attributed to the automobile in our great cities of late is indicated by the following observation on the situation in Boston made by the "Listener" in a recent number of the *Boston Transcript*:

"It is certainly marvellous to see the rapidity with which horseless vehicles are supplanting horses for all the lighter work. Horse-drawn cabs have almost entirely disappeared. Horse-drawn delivery wagons are out of date. Private carriages still go to a great extent with horses; I should suppose they always would, for it is pleasanter to travel with a horse than with a machine. And yet, when automobiles have become considerably cheaper than they are, a great many men will adopt them, though they might prefer horses, simply because less labor and expenditure are necessary to take care of them."

The "Listener" adds that for complete success something horseless needs to be devised to take the place of the ordinary comfortable carryall—a vehicle which, without being bulky, will carry from four to six persons. He also comments on the desirability of providing robes or blankets for automobile cabbies, having noticed that during the recent severe weather, while well clad as to their heads and bodies in good caps and overcoats, they had to depend on their trousers and boots to keep their legs warm.

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The Automobile Club of America is rapidly becoming a large and influential association, who will undoubtedly carry out reforms affecting all users of highways, far more quickly than the Wheelmen's Association could ever expect to do. Cycling is merely a pastime, while automobilism is a new means of traction designed to have an enormous effect on commercial interests.

AUTOMOBILE APPAREL

The leather coat used so much in France does not seem to meet with American tastes. What we need, is a waterproof, wind-proof automobile driving coat, protecting the automobilist thoroughly and effectually against all inclemencies of the weather, presenting at the same time a stylish appearance. Something in the line of a box driving coat of waterproof material, lined with fibre chamois, in order to make it wind proof, and woolen lining. A broad collar and four or five pockets properly located, with perpendicular openings would be advisable. The sleeves should be provided with wind cuffs, and the coat had better be double breasted. Leggins and a wide brimmed felt hat fitting securely would complete the outfit.

TIT FOR TAT

As to automobiles in the parks—why not take the bull by the horns and settle the question for good and all simply by providing that no horse shall be allowed in a park until he has learned not to shy at an automobile? An efficacious test would be to station at each park entrance one of the most formidable kinds of automobile in action. Then at the first symptoms of fright the animal could be turned back. Better still, and in the line both of public utility and of enhanced pleasure, would be to provide that park carriage-services be on an automobile basis. The service would thus be more efficient and profitable, pleasanter for the public, and horses would become so familiarized with motor-vehicles that they would be no more likely to shy thereat than they do at bicycles.

Automobile Humors

AN ELUSIVE PRODUCT

SIMPLEX—How is it we hear so much of automobiles but meet so few of them on the streets?

DUPLEX—Must be the manufacturers are turning them out so fast that you can't see them with the human eye.

RUS IN URBE



ALECK—Well, Uncle ; this is very different from the farm, isn't it ?

UNCLE RUBE—It feels strange, sure enough ; but I guess the owners of them new-fangled things know all about watering their stock, just the same.

C. R. McANDREW, in *Collier's Weekly*.

A CRUEL JEST

"I wish we had a horseless carriage," said the farmer's son.
"We have," replied the farmer ; "and now that you speak of it, you might as well get it and bring a load of potatoes up to the house."

Automobile Humors

DOUBLE SPEED

UNCLE ABE—Dem automobiles go so fast it 'ud take two niggers to tell about 'em.

SAMBO—How's dat?

UNCLE ABE—One ter say "Here she comes" an' one ter say "Thar' she goes!"

A MAN OF PROGRESS



"What luxury! Have you grown too lazy to grind your own stone?"
"Mon Dieu, Suzette, I have to keep pace with our automobile age."

(*O'Galop in La Charivari.*)

THE CHAFFEUR'S APOSTROPHE

My lady ought to be inside—

Auto! Do thy endeavor!

Reinless through lampless streets we glide

While I hug on forever.

Press Notices and Book Reviews

A RECENT issue of the *Automoter and Horseless Vehicle Journal* contains an excellent paper on steam automobiles read by George A. Burls before the Civil and Mechanical Engineers' Society of England. Among other things, Mr. Burls has this to say:

The owners of this steamobile consider that it easily replaces three of their two-horse wagons; that is, six horses, three wagons, three drivers, and three lads. According to Mr. Kempe, one horse working eight hours daily may be expected to maintain a speed of two and a half miles an hour, and perform 14 net ton-miles, on ordinary turnpike roads; two horses harnessed to one wagon may achieve, say, 35 net ton-miles daily, in regular work; 152 net ton-miles per diem will therefore require $\frac{152}{35} = 4.3$ two-horse units; or, say, nine horses. This result suggests that in the estimate just mentioned, "three *two*-horse wagons" should be altered to "three *three*-horse wagons." At a very moderate estimate the prime cost of nine horses, with harness, and three suitable wagons, materially exceeds that of the steamobile, while the total cost of running is almost certainly more than 6d. per net ton-mile; there is therefore a very marked saving in favor of the steam-wagon.

The London *Speaker* in a recent issue, under the heading of "Pace on the Roads," has several remarks to make about brakes. Rightly enough, the great brake power of the wayside "electric trolley car" is alluded to, and also the brake-power of a bicyclist in relation to the weight of his vehicle. It may be that the electric brake is more efficient—somewhat more efficient—than brakes such as those used on railways and by bicyclists, which could quite, and do nearly, stop the wheels from revolving. It is not impossible to supply automobiles with brakes of similar principle and similar power. An active power greater "than that usually applied in propulsion" is certainly wanting, but an equally great power can be called into play; the wheel may be subdued, almost stopped, and Dunlop and MacAdam must fight it out between them. We may hesitate to make any ordinary tire and rim under the weight of an automobile do what steel may do upon steel on the railway, or rubber on macadam, under the light weight of the bicyclist. The thing can be worked out in theory and in practice—will be worked out—is being worked out. We have thought it as well to make our point clear. There are few bogies which terrify the British public so easily as "insufficient brake power."

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The question of dress for a motorist is one of great importance. "I see no reason," says the "Man at the Wheel" in the London *Daily Mail*, "why the appearance of a man driving a motor carriage should differ from that of a man driving a horse-drawn vehicle. But, in consequence of the greater distance covered by the motor vehicle in a day and the more continuous and greater speed at which the motor travels, ordinary tweeds and cloths are unsuitable when there is a cold breath in the air. On the front seat of a motor it is found that the air will penetrate any ordinary cloth. Leather is indispensable, especially where the air pressure tells most—namely, in the front in the region of the shoulders, collar-bones, and breast generally. The black leather jackets worn in France are excellent for protection from wind, rain, and dust, and can be readily cleaned. But, except for long country drives through storm and rain, there is no reason, as I have before said, why the leather coats should be worn; for ordinary tweed suits, if lined with chamois leather, are efficient as protection against penetration of the wind, and the desire of most Englishmen is not to appear on the highways in any form of dress so uncommon as to cause remark. The secret of keeping warm is to wear something tight around or a gauntlet-glove to keep the wind from going up the sleeves."

In "The *Practical Engineer Pocket-Book* for 1900," issued by the Technical Publishing Company, of Manchester, we have a collection of engineering data, formulæ, tables and the like, that is of especial use to the mechanical engineer engaged upon such constructional work as boiler and engine building, hydraulic and automobile machinery, mining engineering, and so forth. The aim of the editor has been to embody his information in plain and concise language suitable for the average mechanic. Such important subjects as fuel, combustion, management of steam generators are treated at considerable length, and even the most experienced boiler attendant will find much new and useful information. The sections on injectors and feed pumps are very practical. There is also an excellent chapter on engine testing and on inertia. This somewhat recondite subject is well covered in the simplest language. There is also a good chapter on electrical engineering. To those who are engaged in mechanical engineering but whose technical knowledge is not extensive we can cordially recommend this pocket-book as being the best of its class, while the advanced student or draughtsman will find it a most serviceable reference book.

Press Notices and Book Reviews

The French publishing house of J. Fritsch has just issued "*Le Manuel pratique du Conducteur d'automobiles*," par Pierre Guédon, ingénieur, et Yves Guédon, ingénieur civil.

This is the second edition, revised and greatly enlarged, of a work of which the first edition has been reviewed in these pages. The success of this book is justified by the large amount of valuable information that it contains. It is divided into seven parts, the first of which is devoted to the subject of steam automobiles. Herein we find some interesting considerations upon the advantages of expansion and of the compound system for the motors of automobile carriages; upon the use of back-steam for brakes; and upon the calculation of the tractive stress of motors. The second part deals with gasoline automobile carriages, such as those of Panhard and Levassor, Peugeot, Lebrun, Gardner, Gauthier-Verhlé, Decauville, Dietrich, Pantz, Henriod, Koch and Roser.

The third part treats of electric automobiles, and contains some general considerations upon electric motors and accumulators. Herein we find descriptions of the Jenatzy, Jeanteaud, Krieger, B. G. S. and Mildé carriages. The fourth part, which is extremely interesting, considers alcohol motors, such as the Briest and Armand and the Martha. The fifth part comprises calculations of work. The sixth part gives descriptions of various accessories. Finally, the seventh part is made up of appendices giving numerous pieces of advice and many reports and regulations concerning automobilism; all very interesting.

An interesting work is Prof. T. O'Connor Sloane's book on "*Liquid Air and the Liquefaction of Gases*." This treatise gives the entire history of the liquefaction of gases, from the earliest times to the present, and also contains a description of all the experiments that have excited the wonder of audiences all over the country. It shows how liquid air, like water, is carried hundreds of miles and is handled in open buckets; also the Formation of frost on bulbs—Filtering liquid air—Dewar's bulbs—Liquid air in water—Tin made brittle as glass—India rubber made brittle—Descending cloud of vapor—A tumbler made of frozen whiskey—Alcohol icicle—Mercury frozen—Frozen mercury hammer—Liquid air as ammunition—Liquid air as basis of an explosive—Burning electric-light carbon in liquid air—Burning steel pen in liquid air—Carbon dioxide solidified—Atmospheric air liquefied—Magnetism of oxygen. Prof. Sloane also suggests what may be expected from liquid air in the near future. Though this is a work of scientific interest and authority, it is written in a popular style, and is therefore well within the grasp of any average reader.

The Automobile Index

Everything of permanent value published in the technical press of the world devoted to any branch of automobile industry will be found indexed in this department. Whenever it is possible a descriptive summary indicating the character and purpose of the leading articles of current automobile literature will be given, with the titles and dates of the publications.

Accumulators—

A serial article, by E. C. Rimington, on the construction of accumulators for automobiles. "The Automotor Journal," London, December 15, 1899.

A Fast American Run—

By Hiram Percy Maxim. "The Automobile Magazine," January, 1900.

An Artist's Appeal—

By Frances S. Carlin. "The Automobile Magazine," January, 1900.

An Improved Explosion-engine—

By Baudry de Saunier. "The Automobile Magazine," January, 1900.

An Improved Power-transmitting Mechanism—

By E. E. Schwarzkopf. "The Automobile Magazine," January, 1900.

A Simple Steering Device—

Patented by R. W. Jamieson. "The Automobile Magazine," January, 1900.

Automatic Starting—

Werhlé device for the automatic starting of any hydro-carbon motor. Description of same, with six illustrations. "La France Automobile," Paris, December 3, 1899.

Automobile Driving for Women—

An expression of views by Mrs. M. E. Kennard, the well-known English novelist, on the subject of automobile driving for women. "The Motor-Car World," London, December, 1899.

Automobile Management—

"How to manage a motor-car." Practical hints to users. A serial illustrated article, by Philanto. "The Motor-Car World," London, December, 1899.

Automobilism and Health—

"Are cycling and automobilism injurious to health?" First serial article of a study of this subject, by Dr. Raymond Sainton, Chief Surgeon of the Péan Hospital (Paris). "Le Chauffeur," Paris, November 25, December 11, 1899.

Automobilism in Italy—

Automobiles and their future in Italy (Gli Automobili ed il loro Avvenire in Italia). Guiseppe Spera. A report to the Commissioner of Public Works, discussing the relation of the automobile to the improvement of highways and the possible competition of automobile traction with railways. "Rivista Generale delle Ferrovie," October 29, 1899.

Carbureter—

Description and illustration of the "Abeille" carbureter. "La Locomotion Automobile," Paris, December 12, 1899.

Care of Storage Batteries—

J. K. Pumpelly's suggestions for the proper care of storage batteries, especially when they are employed in motorcycle propulsion. "The Motorcycle - Automobile," Chicago, December, 1899.

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Charging Plants for Automobiles—

"A few practical suggestions on the installation and management of storage battery charging plant for electromobiles, etc." By J. M. Walsh. "Cycle and Automobile Trade Journal," Philadelphia, January, 1900.

Compressed Air Automobiles—

Full description of a compressed air delivery wagon devised and built by Molas, Lamielle et Tessier, of Paris. One illustration. "La Locomotion Automobile," Paris, December 7, 1899.

Electric Automobiles—

Two novel automobiles. Frank H. Mason. Describes two vehicles exhibited recently in Berlin, the Pieper double-motor carriage and the "Electra." "American Manufacturer and Iron World," November 2, 1899.

The Krieger delivery wagon described and illustrated. "L'Avenir de l'Automobile et du Cycle," Paris, December, 1899.

Description and illustration of the Jenatzy delivery wagon. "L'Avenir de l'Automobile et du Cycle," Paris, December, 1899.

The new Krieger "electrolette" illustrated and described. "La Vie au Grand Air," Paris, December 10, 1899.

The Crowds electric automobile fully described. Two illustrations. "The Motor Age," Chicago, December 21, 1899.

A new Victoria built by the United States Automobile Co. Described with illustrations. "Cycle and Automobile Trade Journal," Philadelphia, January, 1900.

Electric Transformer—

Legros et Meynier's transformer used for charging the ignition accumulators on automobiles. An illustrated description by A. Delasalle. "La Locomotion Automobile," Paris, December 21, 1899.

Explosion Motors (Les Moteurs à explosion)—

A book by M. Georges Moreau. It is a study for the use of constructors and drivers of hydro-carbon automobiles. "La France Automobile," Paris, December 24, 1899.

Fire Engines—

Self-propelling steam fire-engines constructed by Messrs. Merryweather & Sons, with one illustration. "Engineering," London, September 15, 1899.

Self-propelled fire-engine constructed by Messrs. Cambier & Co., of Lille, France. Illustrated. "Engineering," London, November 24, 1899.

Fore-carriage System—

Serial illustrated articles on a new system for the propulsion and steering of automobiles by a special fore-carriage. L. Baudry de Saunier. "La France Automobile," Paris, December 3 and 10, 1899.

Gallery of American Automobiles—

"The Automobile Magazine," January, 1900.

Hydro-carbon Automobiles—

Full description, with six illustrations, of the Julien Bernard voiturette, called "L'Hirondelle Automobile." This vehicle is of novel design and is intended for public service. It has a double or reversible steering gear. "L'Avenir de l'Automobile et du Cycle," Paris, November, 1899.

Illustrated description of the Underberg voiturette. "L'Industrie Velocipédique et Automobile," Paris, November, 1899.

The improved Turgan-Foy voiturette, with divided axle for steering. An illustrated description. "L'Industrie Velocipédique et Automobile," Paris, November, 1899.

A brief description of the "Eole" voiturette, with one illustration. "Le Chauffeur," Paris, November 25, 1899.

The Gobron et Brillié wagonette fully described by Gustave Chauveau. Eleven illustrations. "Le Chauffeur," Paris, November 25, 1899.

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The Pougnaud et Brothier gasoline carriage, called "La Charantaise." A full description of this new vehicle, with six illustrations. "La Locomotion Automobile," Paris, November 30, 1899.

The Panhard et Lavassor gasoline omnibus, described and illustrated. "L'Avenir de l'Automobile et du Cycle," Paris, December, 1899.

A brief description of the new friction-gear automobile built by F. Rough & Co., of Hereford, Eng. It has no chains, belts or toothed gears whatever. "The Motor-Car World," London, December, 1899.

Description of the "Ivel" automobile, built by Mr. D. Albone, of Biggleswade, Eng. One illustration. "The Motor-Car Journal," London, December 1, 1899.

The "Lady" voiturette, built by Mr. H. Cave, of Coventry, Eng. A brief description, with one illustration. "The Motor-Car Journal," London, December 8, 1899.

The N. Bravo gasoline automobile described by Maurice Chérié. With illustrations. "La France Automobile," Paris, December 10, 1899.

Illustrated description of the new two-seated quadricycle, built by the "Société anonyme des Voiturettes Automobiles." "La Locomotion Automobile," Paris, December 12, 1899.

Description of various new devices covered by the patent corresponding to Wm. Wallace Grant's gasoline carriage. "The Motor Age," Chicago, December 14, 1899.

Darracq's gasoline carriage described and illustrated. "The Automotor Journal," London, December 15, 1899.

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The "Esculape" voiturette described and illustrated. "La France Automobile," Paris, December 24, 1899.

Description and illustration of the Bardon gasoline carriage. "La France Automobile," December 24, 1899.

The Bronhot wagonette described and illustrated. "The Motor-Car Journal," London, December 29, 1899.

Description and illustration of the Audibert-Lavirotte carriage. "The Motor-Car Journal," London, December 29, 1899.

The Old and New Bollée Voiturettes. "The Automobile Magazine," January, 1900.

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The Berthier gasoline bicycle described and illustrated. "L'Industrie Velocipédique et Automobile," Paris, November, 1899.

Illustrated description of the new gasoline tricycle made by Mr. H. Mayer, of Berlin, Germany. "The Motor-Car Journal," London, December 8, 1899.

The Shaw gasoline bicycle described and illustrated. "The Motor-Car Journal," London, November 24, 1899, and "The Auto-car," Coventry, December 9, 1899.

Description of the Lamandière-Labre gasoline bicycle, with four illustrations. "The Motor-Car Journal," London, December 29, 1899.

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Description and illustration of the Rhéda motor. "L'Industrie Velocipédique et Automobile," Paris, November, 1899.

Description of the Lucas & Villain motor. Three illustrations. "La France Automobile," Paris, December 3, 1899.

The Sécot oil motor. Hugh Dolnar. Reply to the criticisms of Mr. J. D. Lyon. "American Manufacturer and Iron World," November 9, 1899.

The "Abeille" gasoline motor described, with three illustrations. "La Locomotion Automobile," Paris, December 12, 1899.

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Description and illustration of the Bennett and Thomas gasoline motor. "The Automotor Journal," London, December 15, 1899.

Illustrated description of the Partin motor. "La France Automobile," Paris, December 17, 1899.

A brief description (illustrated) of the Toepel motor for bicycles. It uses kerosene, gasoline or acetylene. "Cycle and Automobile Trade Journal," Philadelphia, January, 1900.

The Ravel "Intensif" motor. By Gustave Chauveau. "The Automobile Magazine," January, 1900.

J. W. Walters' device, consisting of a gasoline motor, a propelling wheel and a steering gear, all combined. The whole is arranged to work as a detachable fore-carriage. Two illustrations. "Scientific American," New York, January 6, 1900.

Igniters—

An article on the problem of ignition and the various kinds of igniters. By C. E. Lee. "The Motorcycle-Automobile," Chicago, December, 1899.

The Apple igniting apparatus as made by the Dayton Electrical Mfg. Co. A brief description with one illustration. "Electrical World and Engineer," New York, December 16, 1899.

Several devices for electrical ignition as used on the Phoenix automobile. "La France Automobile," Paris, December 24, 1899.

Liquid Air—

By Harrington Emerson. "The Automobile Magazine," January, 1900.

Lubricating Device—

Serpellet's "multiple" lubricating device. With three illustrations. "La France Automobile," Paris, December 17, 1899.

Mechanical Traction and Propulsion—

By Prof. G. Forestier. "The Automobile Magazine," January, 1900.

Motocycle Management—

Serial articles, by Mr. A. J. Wilson, under the title of "Motor cycles and how to manage them." With illustrations. "The Autocar," Coventry, December 9, 23, 1899.

Motor Vehicles in the Stock Market—

Editorial discussion and warning, considering the four kinds of motive power used, and reviewing the standing of the industry. "Engineering News," November 2, 1899.

Motor Cycle Racing—

By Al Reeves. "The Automobile Magazine," January, 1900.

Recent Experiences with Steam on Common Roads—

Paper read by John J. Thornycroft, F. R. S., before Section G of the British Association. "Engineering," London, September 22, 1899.

Speed Changing Gear—

Description, with three illustrations, of the W. H. Newman system of speed changing gear for automobiles. "The Engineer," London, December 1, 1899.

The Buchet speed changing gear described. Two illustrations. "The Motor-Car Journal," London, December 1, 1899.

The two-speed gear made by Mr. A. Eldin, of Lyons, France. One illustration. "The Motor-Car Journal," London, December 29, 1899.

Speed Changing Mechanism—

The Delbruck speed changing mechanism described and illustrated. "The Automotor Journal," London, December 15, 1899.

Speed Reducing Device—

L. Brun's *demultiplier* or speed reducing device, described and illustrated. "Le Chauffeur," Paris, December 11, 1899.

Starting Device—

Description of a new starting device invented by the English automobilist Mr. E. Estcourt. One illustration. "The Automotor Journal," London, December 15, 1899.

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Steam Automobiles—

Steam motor-cars constructed by the Steam Carriage and Motor Co., Ltd., of Chiswick, Eng. With six illustrations. "Engineering," London, September 22, 1899.

Illustration and brief description of a new steam carriage built by Geo. A. and Peter Harris, of Manchester, Conn. This vehicle uses soft coal. "The Motor Vehicle Review," Cleveland, December 12, 1899.

Illustrated description of three vehicles of the Leach pattern. "Cycle and Automobile Trade Journal," Philadelphia, January, 1900.

The "Locomobile" described and illustrated. "The Automobile Magazine," January, 1900.

The Marsh carriage and its performances as a fast hill climber. One illustration. "The Motor Age," Chicago, January 4, 1900.

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Illustrated description of the latest steam omnibus built by Dion et Bouton. "L'Avenir de l'Automobile et du Cycle," Paris, December, 1899.

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A short account of some modern steam wagons. George A. Burls. Excerpt of paper read before the Civil and Mechanical Engineers' Society. A general discussion of the efficiency, durability, power, speed, etc., of these vehicles, with table of data, and short discussion. "Automotor Journal," London, November, 1899.

Steam Heavy Weight Wagon—

Description and illustration of the new "Toward" heavy weight steam-wagon. "The Motor-Car Journal," London, December 1, 1899.

Steering—

Serial articles, fully illustrated, on steering by means of the divided axle. Dr. C. Bourlet. "La Locomotion Automobile," Paris, December 7, 1899.

Last of the serial articles on steering by means of the divided axle. Dr. C. Bourlet. "La Locomotion Automobile," Paris, December 21, 1899.

The Automobile Club of Great Britain—

By a founder member. "The Automobile Magazine," January, 1900.

The Automobile in Traction—

By Robert H. Thurston, Director of Sibley College, Cornell University. "The Automobile Magazine," January, 1900.

The Automobile Voiturette at the End of the Century—

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The Buchet Head for Working-chambers—

"The Automobile Magazine," January, 1900.

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Official rules. "The Automobile Magazine," January, 1900.

The Truth About Motor Horse-Powers—

By Georgia Knap. "The Automobile Magazine," January, 1900.

Tires—

Illustrated description of Munger's tires. New patents. "The Motor Age," Chicago, December 14, 1899.

Traction Engines in South Africa—

Description, with five illustrations, of traction engines for common roads, sent to the Transvaal by Fowler & Co., of Leeds, England. "The Engineer," London, December 8, 1899.

Traction Engines in War—

Description and illustration of a military traction engine. "The Engineer," London, November 24, 1899.

Traffic Regulation and the Speed of Motor Vehicles on Highways—

A paper read before the Automobile Club of Great Britain by R. E. Crompton. "The Horseless Age," New York, January 3, 1900.